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ORGANIC GARDENING

EMMAUS, PA.

Vol. 4, No. 4. Mar., 1944 | $3.00 a year | 25c a copy

J. I. Rodale, Editor | Sir Albert Howard, C.I.E., M.A., Associate Editor

With The Editor

Burning of Weeds

THERE is an old saying that "he who plays with fire may expect to get burned." This holds true especially in agriculture. In the Spring we see much burning over of fields in order to destroy previous crop residues, a practice which is highly treasonable to the soil. It seems that man is the only creature on earth that has learned to use fire, but there are many instances where he shows a blundering stupidity in its use. A "scorched earth" policy, is better left for use under military exigencies. And talking about military matters, there comes news from the battle-fronts that the flame-thrower will supersede the hoe as a destroyer of weeds. Poor soil!

There are six important reasons why a fire should never be made where a crop is to grow:

1. It wastes valuable organic materials.
2. It burns out humus in the upper few inches of soil.
3. It cremates earthworms and kills bacteria, fungi, protozoa, algae and other beneficial soil organisms.
4. It dries out soil moisture.
5. It destroys fertility.
6. It is sometimes destructive to general property.

In spite of all these overwhelming reasons the sight of fields deliberately set on fire is quite common. Some gardeners must like the looks of the black, charred remains on the earth and mistake it for humus and fertility. They are wrong.

Burning off weeds on a soil is a negative form of action which must be charged off on the wrong side of the ledger. In many cases such fires are made by persons who state that running our farms with the use of organic fertilizers exclusively is impractical because there isn't sufficient organic materials to go around. The amounts of such material destroyed in this manner each year must be tremendous and would contribute a great deal to soil fertility if it was composted and then applied to the land.

In many cases the weed-growth that is burned is light enough to plow under easily. In such case the better way would be to cut it down and bring the matter in for composting. On a farm, machinery is usually available to cut down and load such green material.

Read Magazine, Inc. Executive and Editorial offices, 6th and Minor Sts., Emmaus, Penna. Subscription rates 12 issues for $3.00. **ORGANIC GARDENING**, published 12 times a year by Read Magazine, Inc., 6th and Minor Sts., Emmaus, Penna. Entered as second class mail at the postoffice at Emmaus, Penna., under the act of March 3, 1879. Printed in U.S.A.

Where the weeds have been growing for many years and are more woody it is a more difficult problem. What I would do in such case would be to go over it with a heavy roller several times in the fall to flatten it as much as possible and then disc it a few times. The effect of the winter snows will be to soften and start its decay. It can then be plowed under in the spring and the land fallowed for a year. This will permit the plant matter plowed under to decay before a crop is planted. Usually enough weeds will come up after plowing to provide a protective cover to the land, without a cover crop being needed. If the fields have been neglected for so long that you have a young forest then it probably would not be within the realm of economy to attempt to raze it.

Humus which takes much effort to build up in the soil unfortunately cannot withstand fire. It burns quite readily. That is why peat is still used as a fuel in such countries as Ireland and Northern Europe and that is the reason why it becomes dangerous if the inside of the compost heap heats up to much more than 150 degrees, Fahrenheit. The tendency of horse-manure to heat up and burn is mentioned here to show that this family of materials is not resistant to high temperatures. Baron Von Liebig in his famous experiment didn't have much trouble in burning up all the organic matter in a plant. Since in many soils the humus is found only in a few inches of topsoil, it is easy to picture the effect of a roaring fire searing and burning out this precious humus.

Fire kills off some earthworms, bacteria and other beneficial soil organisms. The question is how far down does the effect of fire reach? I don't know, but it is a definite fact that the biologic life consisting of bacteria, fungi, protozoa, algae, etc. usually exist only in the upper four or five inches of soil in quantity. Below that, the quantities are practically negligible. Therefore, even if the effect of the flame reaches down but one inch, the amount of destruction to beneficent microscopic organisms must be enormous.

Fire robs the soil of considerable moisture. This is a simple principle of physics which any one will admit. Heat evaporates water. For that reason you wouldn't make a fire next to a compost heap. In a year of unusual drought, the fact that the land was burned over in the spring, might be the determining factor in a crop failure. In regions of low rainfall it would be sheer folly to burn anything on the soil. In such sections the land is often fallowed every second year, because a fallow is known to save up water in the soil and the crop gets the benefit of two years of rainfall. Civilizations have fallen because of lack of rain. So the application of fire to the soil would appear to be a violation of one of the simplest principles of agriculture.

J. Hunt Holley, writing in the Farmer's Weekly of Bloemfontein, South Africa (1942) says that veldt-burning has destroyed the fertility of millions of acres of land in Africa. This practice seems quite common in that part of the world. Mr. Holley states: "During the past seven years a neighboring farmer has had 54 floods. We had none, despite the fact that we have from 100 to 300 per cent more fall in our streams. In the heaviest rain no stream on our farm rose more than six inches.

"The cause of this improvement lies in humus. I have not burned vegetation since 1902, though I did in 1923 singe one farm after rain. This leaves a lot of humus for the enrichment of the soil. Humus has restored the soil and enabled me to produce a wide range of crops."

On an automobile trip to Chicago about five years ago we saw many fields being burned. It was a sickening sight. In one case I recall seeing a farmer burning many high stacks of straw. He probably did not realize its worth. Last autumn in driving past a neighbor's farm, I saw him burning some heaps of buckwheat straw. I stopped and explained the effect of fire on his soil. He had neatly piled up about 50 piles of the straw but fortunately had burned only 5 and was glad to stop.

As this goes to press one of our friends from Salt Lake City, Utah writes, "The Commissioner of Streets of Salt Lake City tells me that the city is seriously considering buying some burning outfits to fit on street trucks to burn leaves right in the streets so they won't have to be hauled. I told him, earnestly, it would be almost a crime against the soil and, hence our civilization itself, if this goes through; so won't you write him a letter?" Thousands of tons of leaves are burned each year in this enlightened country, but it is encouraging to note that where the matter is explained properly, this unnecessary destruction is stopped. When newspapers editorialize about it, gardeners usually become compost conscious. One such editorial

in the city of Allentown, Pennsylvania last fall created wonderful results. You could see many compost heaps blossoming forth as a result.

The amount of property that is destroyed by some of these weed-burning fires getting out of hand must run into a considerable sum each year. There was a case recently where such a blaze destroyed valuable young fruit trees. Some time ago the town of Bandon, Oregon was completely razed when a few fires started by farmers burned their way into town due to an unexpected wind coming up. Eleven people died. There was a $6,000,000 fire at Berkeley, California many years ago which was an outgrowth of a small weed-burning fest. Six hundred buildings were destroyed.

One would imagine that the intense heat of a fire would burn out the arsenic, and similar metallic poisons that have been sprayed on the land and in that way, at least partly pay up for the damage done. But it is a well-known fact that even fire does not destroy arsenic. In fact nothing can destroy it. There is exactly as much arsenic, lead, mercury, etc., in existence today as there was when the world was formed.

It is exceedingly dangerous to burn off grazing land in the early part of spring, as it may cause fire injury to grass roots and seed crowns. When a farmer is depending on a certain amount of hay from his pasture for summer feed purposes he may be terribly disappointed in his supply if he burns off the land cover.

In spite of all these facts some agricultural text-books actually advise the burning of fields which are badly infested with weeds. Occasionally you hear a dissenting voice, such as T. J. Murray who in a December, 1921 issue of Soil Science said, "The practice of burning wheat stubble on the farm is common but such procedure is detrimental to permanent agriculture."

An experience we had on our own farm convinced me of the obvious danger of making bonfires on the land. Our farmhand made a series of small fires along the edge of a field last summer to burn up some corn-stalks, not being aware of our policy against fires on the land. Later, the field was sowed with barley. In due time the sprouts began to make their way to the surface and the field became a beautiful green *except* at those spots where the fires had been. These spots showed up a yellowish color. It was so distinctive that visitors to our farm remarked about it and called attention to the fact that the barley that did come through on the sites of the former fires quickly turned a yellowish color and didn't thrive as well as the rest of the field.

Occasionally a farmer will tell you he has heard that burning the land is good, because the ash residue is potash which helps the crop. This is a carry-over from pioneer days when everything was forest and the soil was black and loamy. To make clearings for growing crops the trees were girdled and left to stand for a year or so in order to die and dry out. Then the torch was applied. No doubt good crops were obtained on such lands because of the rich virgin soil, in spite of the fire. Under the conditions then existing it was the only thing that could have been done.

These burnings are vividly described in a novel called "The Trees" by Conrad Richter (Alfred A. Knopf, publishers). There are several priceless agricultural "rules" given in that story that I must repeat here: "Portius told him how a man named Vergil gave a rule in a book for testing your ground. All you need do was dig a hole. If the dirt you took out went back in with room to spare, your ground would grow most anything. And Big John, not to be outdone, told Portius the rule that when a man could go out in his fields and put down his britches and the air would not feel cold on his bare parts, then it was time to seed corn."

The 1938 U. S. Agricultural Year Book p. 741, gives a gloomy picture of the burning of forests and its devastating effect on the soil. Some excerpts follow: "When cut-over land is burned the fire accomplishes in minutes the degree of litter removal that would be achieved naturally only after several years. This sudden removal of the litter and its living population sets in motion a chain of events leading directly to deterioration or loss of the soil. The highly alkaline ash is leached or carried into the soil with the first rains and there acts to deflocculate the soil granules made up of silt and clay particles. The dispersed soil particles, readily taken into suspension by falling rain, are carried into the soil channels and clog them, and surface run-off and erosion begin immediately. Loss of the surface soil, reduced infiltration of water, and desiccation rapidly reduce the soil populations. At the same time increased soil temperatures result in rapid oxidation of humus, still fur-

ther reducing the fertility already impaired by loss of nitrogen during the fire.

On light sandy soils of low gradient the processes are similar except that erosion is not a factor. In its stead the essential bases are leached deeply into the soil and in effect are lost. The organic matter, the soil and litter organisms, and the nitrogen disappear just as completely as though washed away, and the surface layers are left in a sterile condition unsuited to the establishment of a new forest. Outstanding examples of the results are found in the pine plains of the Lakes States, the Cape Cod section, and the pine barrens of New Jersey."

* * * * *

"Even though not accompanied by cutting, forest fires are a major factor in the degeneration and destruction of forest soils. They vary in intensity from the spectacular holocausts that destroy the forest completely to the innocuous-appearing leaf fire that consumes only part of the litter. The seriousness of their effects on the soil varies accordingly.

"Extreme soil temperatures frequently develop during the great conflagrations and humus in the upper horizons is oxidized immediately. The mineral soil has much the same appearance as samples ignited in a furnace. Accumulations of heavy debris burn with such intensity that the soil is sterilized for years. Examples have been observed where tree reproduction has failed to become established on such spots more than 10 years after the fire."

* * * * *

"Following the great conflagrations of 1910 and 1919 in the forests of the northern Rocky Mountains observers have reported the loss of as much as 5 inches of topsoil over extensive areas."

* * * * *

"The degree to which soils become compacted following forest fires is shown by the results of an experiment conducted in hardwood stands in the Central States. Water was applied to both burned-over and unburned soils and the rate of absorption per second was measured. Undisturbed soil absorbed the first application three to four times as rapidly as the burned soil. The fourth successive application was absorbed by the unburned soil 6 to 10 times as fast as by the burned."

* * * * *

Many farmers burn corn stubble to eradicate the breeding place of the corn borer who loves to propagate in after-crop plant rubbish. This is a vexatious problem to the NPK farmer and shows the ultimate effect of the use of chemical fertilizers. It produces immediate results but leaves its mark on the land. The farmer who for five or six years has used nothing but organic composts has little to fear of the corn borer. J. Sidney Cates writing in the Country Gentleman has shown that only one application of manure has eliminated root-rot in the cotton crop.

It is usually recommended that the residues of a diseased crop be burned up for fear of contaminating the soil. However, it has been conclusively demonstrated that the careful composting of such green matter makes it absolutely safe for use on the land. Sir Albert Howard, writing in Organic Gardening said, "It was emphatically stated by the entomologists and mycologists that noxious insects and fungi would be certain to survive the compost heap and that the Indore Process would lead to the spread of disease and the virtual elimination of the crops to which the humus was applied. When Mr. A. R. Wills at Romsey in Hampshire demolished these fears by composting the haulms of 3 acres of tomatoes attacked by the wilt fungus, by applying the humus to the soil of the same greenhouses and then raising a fine crop of tomatoes completely free from wilt, the bottom fell out of the pathologists' case. This pioneering work was followed by many other examples in which composted vegetable wastes, yielded by plants attacked by insect, fungous and even virus diseases, gave rise in all cases to perfectly healthy crops. The pathological assault has everywhere proved a dismal failure."

Fire in the Orchard

Another questionable application of fire is the burning out of caterpillar nests in fruit trees before the spring season opens up. A long stick with something, such as a corn cob, at the end that can be set afire is applied to the nests, but unfortunately besides destroying the caterpillars it damages branches and buds. The flame is not controllable. I am experimenting with a device that I am having made which will consist of a heating element without a flame. It will merely apply heat, and only to the point where the nest is.

Sterilization of the Soil

While on the subject of fires we might discuss the question of applying high-heat to the

soil. In recent years it has become the fashion to heat-sterilize soil that is to be used in flats for growing seedlings. This is done for the purpose of destroying disease-producing organisms such as certain kinds of fungi, bacteria, etc. Unfortunately, such heating kills off friendly organisms too. Sterilization, for example, kills off fungi which form the wonderful Mycorrhiza fungus.

Certain practices seem to violate fundamental rules of nature and it takes just the simplest kind of common sense to recognize them. To burn or sterilize soil would appear to be extremely artificial and is not duplicated anywhere in Nature. If the soil is rich in fine compost (finer for a seedling flat than for regular use) Nature's processes in the soil will set up conditions beneficial to the health and ruggedness of the seedling.

Cynthia Wescott, writes beautifully in the New York Times of the soil's microbiology:

"Most people, including beginning gardeners, think of a lump of earth as an inert mass. The green-thumb gardener knows instinctively that soil is a living, sentient thing. but only the soil microbiologist, who sees with the eyes of a microscope, is fully aware of the enormous population and intense activity of the subterranean world. In one gram of soil—less than a teaspoonful—there may be more than a billion bacteria, several million yeasts, thousands of fungi and algae and more thousands of small animals such as protozoa and nematodes.

"Most of these organisms are beneficial. They break down organic matter, they form nitrites and nitrates, they oxidize sulphur and iron, they destroy other harmful organisms. A complete sterilization of soil, halting all life processes, would be disastrous."

Even a partial sterilization holds hidden dangers. Professor Selman A. Waksman in "Principles of Soil Microbiology" (Williams and Wilkins) says, "While treatment of soil at temperatures lower than 100 degrees C. render the soil more fertile, temperatures higher than 100 degrees render it less fertile. The lower temperatures bring about an increase in the soluble organic matter; treatment of soil at higher temperatures (especially above 100 degrees C.) results in the formation of substances toxic to the growth of higher plants: among those, guanine, arginine, dihydroxystedric acid have been recorded. There is also an increase in acidity."

How can an ordinary person working with simple household cooking and heating appliances control the temperature? One authority says that partial sterilization may be effected by baking the soil with a medium-sized potato in the center of the pan. When the potato is done, so is the soil. Why waste a perfectly good potato? Sir Edward Russell says, "When a rich soil is heated some substance is formed which is toxic to plants." He doesn't mention degree of heat. When your hopes of an entire summer are concentrated on the health of a tiny bit of soil why take a chance?

One of the readers of Organic Gardening, Manuel Calvo, of Kensington, Md. writes, "You say that it is a hunch with you that soil sterilizing is a wrong practice. Well, it is just a hunch with me that your hunch is right. Here are my reasons:

"The time came early in March to plant my Tomato seeds, and to improve in my own improvements I sterilized my soil by steaming it in a sort of Bain Marie. That could not fail. The seeds germinated in due time and very soon I had a good stand of seedlings, but all of a sudden the seedlings stopped growing, began to shrink, to turn yellow and to die fast. When I had fewer than the required minimum I sank the flats with the seedlings in a solution made of water and compost, the formula for which I had found in some number of Organic Gardening. The response was almost instantaneous: the mortality was arrested though not entirely stopped, the seedlings revived and started to grow, I kept on nursing them with what I call *compost broth made by mixing very finely ground and sifted compost with water and stirring till it is almost a liquid jelly.* The seedlings are not very large but they are stout with wooly stems the thickness of a pencil.

"The proof may not be conclusive but it is all the proof I want. I will not sterilize the soil any more."

Compost water is made by letting water soak in compost and permitting it to drain off. Such water is extremely rich in all the nutrients contained in the compost and is in a very convenient form to use for special purposes.

When soil is needed for seedlings the outside temperature where it is obtained may be low. Such soil could be gently warmed by placing it over a couple of electric light bulbs for a short time. It might be placed on a high shelf over a

stove but care must be taken that it does not burn or dry too much. Only the most delicate of warming is recommended because we are not doing it to kill organisms. We want a gently warm soil because we know that a cold temperature in the seed-bed is definitely hurtful to the propagation of seedlings. If possible let it warm up by natural methods.

Sterilization is a symptom. It is a clinching argument against the use of the so-called chemical fertilizers, because their use brings about the need for sterilization.

The organic gardener, who loves the soil, would hesitate before sending it through a fire bath. If he has been following Nature's method for a few years he will have soil which, to begin with, will require no sterilization.

J. I. RODALE.

Soil Fertility — The Foundation of Agriculture

BY SIR ALBERT HOWARD, C. I. E.

SOIL fertility is one of the common denominators of human life for on it ultimately depends the health of crops, animals and human beings. Agriculture, which is woven into the fabric of life of every nation great or small, must therefore be built up on the solid foundation of a soil in good heart. But for many years Western agriculture has suffered from banditry. The profit-makers with their artificial manures and poison sprays, and with their tractors and quick-return methods have preyed on the stored fertility of the past and have ignored all claims of posterity to the use of a soil unimpaired in its capacity for crop production.

The exceptional circumstances of war-time have accentuated this banditry, because of both shortage of labour and the need for an ever increasing supply of home grown food. A policy of cashing in on the stored fertility of the soil and producing crops in quantity rather than quality was almost inevitable; but with attention now turned to post-war planning and re-construction there is at last a growing tendency to call a halt to this exploitation and seek the means of replacing and maintaining the soil's capital—fertility.

But the replacement of this lost fertility does not merely involve the addition of increasing quantities of nitrogen, phosphates and potash, produced in a factory and distributed from a bag, as so many laboratory-bound scientists and the producers of these inorganic substances would have us believe. Evidence is daily accumulating of the increase of disease and the loss of reproductive power among crops thus artificially fed. For the plant under natural conditions of growth feeds in two ways simultaneously: first, by means of the root hairs which absorb water and dilute mineral salts obtained by the oxidation of humus in the soil, and secondly, by means of the mycorrhizal association is a composite structure made up of threads of fungous tissue (mycelium) which feed on the soil humus and surround or invade the young cells of the root where fungous and plant cells live together in partnership (symbiosis); eventually the fungous threads which are rich in protein are digested, the products of digestion passing, with the mineral salts taken in by the root hairs, into the sap current which carries all this food material to the green leaf. The efficient development and working of the mycorrhizal association depends on humus and no amount of inorganic minerals in the soil can act as a substitute—rather the addition of these chemical products tends to check the development of mycorrhiza and so interrupts the natural circulation of protein from soil to plant, plant to animal and man, and back again from animal and man to the soil. The results obtained by science in an attempt to interpose a substitution phase—between soil and crop—for this protein transference, by means of artificial manures, are not impressive. Large crops can be obtained for a few years by the use of chemicals, but they lack taste and quality, and soon fall a prey to insect, fungous and virus diseases. Moreover, three other untoward things happen: (1) the crops gradual-

ly lose the power to reproduce themselves; (2) the soil is soon beggared and eventually goes out of cultivation, and (3) the loss of disease resistance in the crop, due to the use of artificial manures, is passed on to the live stock and to mankind. Protein transference cannot be achieved by artificial means. It is an essential factor in Nature's round.

How then are we to set about this great task of increasing and maintaining the humus content of the soil?

The first step should be to make use of the vast stores of humus to be found in the controlled tips round our big towns, where the dustbin refuse of years has been dumped. The refuse slowly ferments—during which process any pathogenic organisms which might be injurious to health are completely destroyed—and after a lapse of eighteen months to two years a controlled tip has become a humus mine. The fine humus within only needs to be separated by screening from the coarse refractory material, such as metal and glass, and is then ready for application to the land. Here then ready to hand is a considerable initial supply of ready made humus.

The next step is to reform our manure heaps. What is wrong with our manure heaps? Everything: they smell, they attract flies, they ooze noisome liquids, all of which is Nature's way of drawing attention to our bad management. Our muck heaps are in process of putrefaction; they are the abode of billions of micro-organisms which thrive in the absence of oxygen and destroy valuable proteins in the manure heap, releasing into the air the combined nitrogen which the heap contains in the form of ammonia and free nitrogen. The farmer who is content with a manure heap of the ordinary type destroys the most valuable form of combined nitrogen known and then tries to replace it by paying out good money for an inferior substitute like sulphate of ammonia. But Nature—the supreme farmer—conducts her manure making on the floor of the forest without smell, without fly breeding, and without loss of valuable elements of plant food. Here an ideal mixture of loosely packed vegetable and animal wastes in correct proportions falls on the ground. The mixed litter is kept moist by the rainfall. Moulds and microbes—Nature's unseen labour force—then ferment the mixed wastes. The undecomposed residues amalgamate with the dead bodies of the moulds and microbes which have done their job, and a new substance—humus—results. Four things are used in its production: mixed vegetable and animal wastes, air, water and soil. The soil is brought up by earthworms in their casts, while the air and water come from the atmosphere.

So on our farms and in our gardens we must copy Nature by replacing the old, wasteful, evil-smelling muck heap by the compost heap and turn all our waste products, just as she does in the forest, into humus. Imagine the fermenting litter from the floor of the forest piled loosely, layer above layer, in a heap to a height of four to five feet. All that is needed is to mix the available vegetable wastes of the farm or garden, any any town wastes that can be obtained, with farm yard manure in the proportion by volume of three or four to one, to cover each layer of mixed wastes with a sprinkling of soil (mixed with wood ashes and powdered limestone or chalk when available), and then to keep the heap as moist as a pressed-out sponge and provide extra air by means of vertical vents about four inches in diameter and four feet apart. If the heap is properly assembled, there will be no flies, no smell, no oozing liquids; the temperature will rise in the initial stages of decomposition to about 150 degrees F. and on completion of the process, which takes about ninety days, the heap will be composed of a sweet-smelling, friable, soil-like substance ready for application to the land.

During the process of decomposition, however, the heap must be turned, and this, with the work involved in assembling the materials in the first place, does, under present conditions, create a considerable labour problem. But necessity is the mother of invention and a muck-shifting crane is now in actual process of construction, which, driven by a tractor, will be capable of assembling and turning the compost heap and loading the final product into a manure distributor. If all goes well, this machine should be available in 1944, and with the return after the war of many more workers to the land there seems no reason why compost making should not become a recognized part of normal farming practice.

Compost is a complete and balanced organic fertilizer, the value of which cannot be assessed in terms of the customary chemical analysis, for it has been found that in their organic form nitrogen, phosphate and potash are much more valuable. Experience has

shown that the market price of organic manures, based on supply and demand, is anything from two to two and a half times greater than that calculated from the chemical analysis. The unit system of valuation applies only to artificial manures like sulphate of ammonia made in factories; it does not hold in the case of natural manures like humus.

The superiority of crops grown with this reformed manure over those grown with old-fashioned farm yard muck must be seen to be believed, and the soil itself can be induced to manufacture humus *in situ* by the reform of the temporary ley. (Grass-pasture). For this three things are needed: (1) more air in the sub-soil, which can be provided by the sub-soiler, (2) more animal manure or compost to rot the turf properly when it is ploughed in, and (3) deep-rooting constituents in the ley—chicory, burnet, cocksfoot, sainfoin and lucerne (alfalfa)—to bring up the lime, phosphate and potash from the deeper soil layers. We must get out of the sub-soiler and the ley all the advantages which re-afforestation could give us—a well cultivated sub-soil and a richer surface soil. A mole-draining outfit can easily be converted into a sub-soiler by replacing the mole by a suitable sub-soiling snout, and the use of a sub-soiler, coupled with such farming methods as were worked out by the late Mr. R. H. Elliot some fifty years ago and described in his book, *The Clifton Park System of Farming*, will produce quality in the ley and not mere yield.

This in turn means quality in live stock, because high quality in fodder and forage is the best means of keeping animals in good fettle. The late Sir Bernard Greenwell, who used the sub-soiler extensively and also manured his land with many thousands of tons of compost, found that infant mortality in pigs and chickens fell almost to nothing, sheep, cattle and horses improved in health, and a saving of 10 per cent. in the grain ration was achieved because grain from really fertile soil was found to possess more satisfying power than grain grown in the ordinary way. During the last few years these results have been confirmed and elaborated by a Wiltshire farmer, Mr. F. Sykes—the designer of the new muck-shifting crane—who at an elevation of nearly 1,000 feet has turned derelict down-land, bought for £4 an acre, into a veritable garden of Eden, producing unequalled crops of wheat and other cereals, while his animals, properly tended and fed on the produce of well cultivated, humus-filled soil, are in fine fettle.

These are the consequences of proper attention to soil fertility and it is a logical conclusion that that which produces health and disease resistance in plants and in animals will also produce health and disease resistance in mankind, although evidence in the case of human beings is much more difficult to obtain. Few people, indeed, in the whole world are in these days living on an exclusive diet of fresh produce from really fertile soil. Yet the indications that this conclusion is justified exist.

In the mountainous valleys of the Gilgit Agency in northern India live the Hunzas, a hardy, agile and vigorous people. Their diet is little or no different from that of other north Indian tribes, but their food is produced on irrigated, terraced land which has been maintained for thousands of years in a high state of fertility. The total area of these irrigated terraces is small, but ample soil aeration results from their construction; the irrigation water brings annual additions of fine silt produced by the neighbouring glacier; the very greatest care is taken to return to the soil all human, animal and vegetable wastes, after being composted together, and all the information which has been gathered together on the physical condition of the Hunza people stresses their marvellous agility and endurance, good temper and cheerfulness. These men think nothing of covering the sixty miles of Gilgit on foot in one stretch, doing their business and then returning.

Under present-day conditions in this country it would be difficult, if not impossible, to carry out fully conclusive experiments on the rôle of humus-grown food in health promotion. Resident communities living solely on the produce of land under their own control are not easily discovered. Nevertheless, what more promising field for operations could be found at the present time than the school gardens and school canteen meals now being started all over the country? Here is an opportunity which we can ill afford to miss, if we intend to build up in the coming generation all the qualities—physical, mental and spiritual—which will enable them to solve the world problems that await them. Our schools ought to be made the nurseries of an A.1 population. Once the school gardens are in good heart, their

fresh produce can be used in the school canteens, and with the help of an agricultural system based upon the reform of the manure heap and the reformed temporary ley, the children of Great Britain could be provided with the best food our islands can produce—fresh vegetables and fruit from fertile soil, whole wheat bread, meat, milk and milk products from land properly farmed and kept in good heart. It will not do in future to compose school meals of produce grown anywhere and anyhow. To be satisfied with this would be to lose a great national opportunity in nutrition, in education and in statesmanship. Every boy and girl passing through our elementary and secondary schools must understand that a fertile soil means healthy crops, healthy animals and last, but not least, healthy human beings. With all the new schemes for reformed education now on foot let the responsible authorities remember that "the wealth of a nation lies not in the material resources at its command, but in the energy, initiative and moral fibre of its people: without these attributes no country can remain permanently prosperous, with them no unfavourable circumstances can long prove an insuperable obstacle." Our greatest possession is ourselves, and the school is the crucible in which this possession can be made or marred.

Here then is an ideal for the agricultural industry—to replace the old profit motive by the motive of health. This is a principle which should, moreover, establish that desirable and necessary link between urban and rural areas. Let our cities convert all their wastes into compost so that our fields may be restored and kept in good heart. Let our townsmen and countrymen alike in their own gardens and allotments, with the children in their school gardens, produce vegetables and fruit of real quality and nutritive value by means of humus, that all our people united in common endeavour may eat of the fruits of their labour and enjoy the health which is their birthright. Here is a motive worthy of man as he was intended to be, a motive worthy of a world where the idea of community is honoured and the inter-relationships of man with man are based upon mutual service and goodwill.

Roger W. Babson Discusses Hidden Factors in Soil

Courtesy PUBLISHERS FINANCIAL BUREAU

BABSON PARK, Mass., Feb. 4. Without doubt land is one of the best hedges against inflation. Hence, it is reasonable that a land boom is now starting in the Middle West. To such readers as are now tempted to buy agricultural land, I wish to say a word in my column this week. Land varies so much in productive qualities that it is foolish to talk about any price as "fair" for land. The price should depend upon what kind of men it produces.

Insist on Highly Productive Land

To begin with there is the question of crop productivity. Some land in Nebraska, Kansas or Iowa is much cheaper at $200 per acre than other land in the Dakotas at $20 or even at $200 per acre. The quantity of corn, wheat or whatnot that any acre of land will raise on a ten-year average is the first step in determining a just price. Hence, before buying or selling land get the figures on what it has produced in the past. By all means avoid buying *unproven raw* land.

The second question to consider is what the land's location and climate are best suited to produce. For instance, I have four tracts of land in mind in Florida which all look the same to a novice. Yet for one tract, suitable only for pasture, $15 per acre is a fair price; for another, suitable only for citrus, $40 per acre is a fair price; for another tract on the East Coast, suitable for beans, $200 per acre is a fair price; while the best bargain of all is a tract in Sanford, Florida, at a price of $1,000 per acre, which is ideal for celery. Yet land may be highly productive and profitable commercially while the stuff which it raises may have very little nourishment. Hence, it will not raise strong families.

Have Soil Analyzed For Minerals

For those readers who want not a commercial farm but a small sustenance farm for raising and feeding a good family of children, there is a third series of questions to consider. The farm should be within walking distance of schools, churches and stores, or else on a bus line; it should have drained fertile land; and it should have good neighbors. In addition, the land should contain the right minerals for making brains, brawn and character. All we are—except for our spiritual and physical heritage—comes from what we eat, drink and breathe. This means that the soil in which our food and fruit are raised is of great importance in determining our health, intelligence and character.

Why do the best trotting horses come from Kentucky? The answer is in the soil and this applies only to certain small sections. Why have the best brains grown in certain valleys of New England, New York State, Pennsylvania and Virginia? The answer is that the soils of these valleys—washed down during the centuries from rocky hills—contain the needed minerals to make the best brains. I have especially in mind potassium, phosphorus, iron, iodine, calcium and magnesium. If you doubt me, ask the publishers of "Who's Who's" to give you their opinion on this subject.

This third factor of the mineral content of the soil, including the treatment of the soil, is now very seldom discussed. The Department of Agriculture has avoided reporting on it because it is a "hot potato loaded with dynamite." However, it is of prime importance to every family planning to live on the products of its own land. Furthermore, the time is coming when vegetables and fruits will be sold under the Pure Food and Drug Act according to their mineral content, whether sold fresh, canned or dehydrated. Some beans may be cheap at $10 per bushel, while other beans, which appear just the same, may be worth only $1.50 per bushel and good only to eat for bulkage. Hence, by all means consider this mineral content, needed for brains and character when buying land. If you cannot afford to consult a high class soil expert, *go to the nearest graveyard, study the headstones and see how long the people lived.*

Why Germany is Hard to Lick

I pass on just one more thought for readers to ponder over. It is this: Some years ago when I was in Switzerland making a study for the *New York Times*, a Swiss scientist said to me: "Europe will always have trouble with those Prussians. There is something in the soil of Prussia which grows people with that fighting instinct. European peace is unalterably linked up with the minerals of the soil. Permanent peace in Europe will come about only by sytematically moving people about. That is the only way physical, economic and spiritual opportunities can be equalized."

Certainly there is a relation between soil and fatigue. For a scientific study of fatigue, send ten cents to the Medical Journal and Record Publishing Co., 667 Madison Ave., New York City for Dr. Max B. Gerson's article published in the Medical Record of June, 1943.

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P.S. Churchill believes in the importance of soil. This is why England will try to take Belgium, Holland and the other Low Countries into the British Commonwealth and is willing to leave Austria, Czechoslovakia and the Baltic States to Stalin.

Scrub Palmetto Put to Use

The scrub palmetto, hitherto considered in its habitat a worthless plant, has been put to work. Its pith and fiber are being processed into many ordnance items and for such civilian uses as wallboard, floor and wall tile, cold storage insulation, steam pipe covering, gaskets, plugs, spools, fishing rod handles, brush bristles, upholstery and twine. The palmetto supply is inexhaustible. There are 17,000,000 acres of land dotted by the scrub in Florida alone.—And (Note By Editor of Organic Gardening) —please study into the possibility of using some of this precious organic matter in the soil.

Hints For The Victory Gardener

This is the sixteenth of a series of articles by this author dealing with the cultivation of ordinary vegetables.

BY ROGER W. SMITH

TAMPALA

THIS season you will want to try out a short row of this newly introduced "greens" vegetable. Tampala is a recent arrival in American gardens although it has long been grown in the Orient. As a garden delicacy it is known to Chinese gardeners as Beh Han Tsai (White Salty Vegetable) but it comes to you under its Ceylonese name "Tampala".

Tampala is not related either to Australian Spinach or to Orach, which it somewhat resembles. It is a member of the Amaranth family. The ornamental Amaranth, as you know, bears maroon or reddish flowers which do not readily fade and which are sometimes used to symbolize immortality.

It may be that Tampala will replace spinach in popularity, just as spinach suddenly replaced that now almost forgotten favorite orach, for tampala has much in its favor.

Tampala is a warm weather plant. The seeds should not be sown until after the ground has warmed up. When weather and ground are cool, you will have difficulty in getting the seed to germinate; but if you plant the seed after the ground is thoroly warm, it will sprout within a few days.

Any fairly good garden soil is suitable for the growth of tampala but it is essential that the soil contain an ample amount of organic humus, preferably properly composted materials, to maintain a maximum amount of soil moisture, otherwise the plants will suffer during protracted dry spells.

Because of the small size of the seed, a very good plan is to mix it with clean, dry sand, one part of seed to ten parts of sand. It is easy then to plant this mixture in a thin line along the bottom of a shallow drill. The seed should be covered with not more than one quarter of an inch of sifted compost humus and carefully firmed.

The rows should be at least three feet apart to allow room for the luxuriant growth which the plants develop. For the same reason, the seedlings should be thinned to stand not closer than two feet apart, in the row. If you wish you can use the plants removed at thinning to start a new row, but you will likely prefer to wait until they are about six inches tall when they may be used as a kitchen delicacy.

Tampala thrives during the long summer months. Spinach prefers cool weather and will bolt and run to seed during hot weather. Tampala, on the other hand, will not run to seed because of heat. You can expect to have the plants well established and to make the first picking within seven weeks from the time of planting the seed. The plants have a very long period of usefulness. However, for a steady supply of the very tenderest leaves, you will be wise to make several successive sowings about three weeks apart.

Tampala makes a very attractive, compact, bushy plant usually about twenty inches high and twenty inches across. Many new branches develop from around its base. It will thrive in either a moist or a dry climate and if local conditions are exceptionally suitable, it will form a bush of much larger dimensions. It forms a leaf blade about five inches long and three inches broad and because of its upright habit its leaves do not come into contact with the soil and are, for

this reason, generally bright and clean and free from grit. Throughout the summer the plants will continue to grow and to provide a heavy supply of edible leaves, but during short days and cool nights they will flower at any stage of their growth.

If you dislike spinach, tampala will likely be very welcome to your garden. It is considered of much better quality than spinach and preliminary tests tend to indicate that it has much greater food value.

The branches of the plant are also edible. When they are from six to eight inches long they may be cut and cooked like asparagus—from six to ten minutes. The leaves are cooked, of course, in the same manner as spinach. They retain their green color during cooking—always a good sign with a "greens" vegetable—to a much greater extent than spinach and you will discover that the flavor of tampala is also quite different.

The Chinese name, White Salty Vegetable, is very applicable for the plant has a salty tang, probably because of its high mineral content. Little salt, if any, should be used in its preparation. But the Chinese name doesn't begin to describe its smooth richness of flavor and that homely touch of something that will remind you of sorrel. It has none of the harshness so much associated with most "greens".

Although tampala has been grown by Asiatic gardeners since long before recorded history, it is still as vigorous and sturdy as a wild plant. In America it has so far proved exceptionally free from plant disease and attacks from insect pests. It demands only that it be given a place in the sun and that the soil about it be reasonably rich in fertile humus, with perhaps, a light mulching of compost humus around it during the heat of the summer. It seems, indeed, a plant well fitted for the Victory garden.

But whatever your opinion may be after you have tried this new arrival, and you will probably like it very much, you will enjoy meeting it and in the growing of a short row of tampala you will doubtless find much pleasure and a source of many delightful little discoveries.

A Sense of Humus

A Chapter From The Book "A Sense of Humus"

BY BERTHA DAMON

Published by Simon and Schuster, N. Y. C. ($2.50)

THE importance of humus in human economy seldom receives sufficient emphasis. Suffice it to say that it probably represents the most important source of human wealth on this planet.—S. A. Waksman: *Humus.*

To consider humus is to get a hint of the oneness of the universe. All flesh is grass, in more than the figurative sense the prophet intended. During the long history of this planet, weather has disintegrated rock, tiny lichens have made a speck of vegetable mold, countless generations of short-lived weeds have waxed fat for a summer, giant forests have flourished for an aeon, and all in turn have died and given back to the earth more goodness than they have taken from it. All have been composted into humus. And the life of insects and of animals and of men which was sustained upon the life of these plants and upon the life of other animals, all these creatures too have enriched the surface of the earth with their excreta and finally with their bodies. All in turn have been composted into humus.

A humusist is a dirt gardener who has found out that the only valuable part of the "dirt" in which he gardens is the "topsoil," that organic material composted by time from living

organisms which having once had life are rich with elements which life can again assimilate. He has found out that the layers of sandy stuff and hardpan below are but the table and the floor on which is spread the real food. Knowing that much, a dirt gardener knows that if his "dirt" lacks humus and he lacks sense of it, he can buy plants until he is bankrupt and stick them in all over the place until he is exhausted, and no good will come of it. If, beyond this, he has discovered that what is true of his soil is in a figurative way true of his soul, then he has become a higher humusist.

But first, the "dirt." The more I came to know about humus, the more I knew what had been the matter with our lawn that wouldn't be lawn and our perennials that wouldn't be perennial. I had at length acquired a sense of humus; all I needed was some humus—and there I fetched up short. What humus? Where from?

Well, a deal of leaf mold was still in the woods. Samule, by request, scraped up a few loads and dumped them in a heap near the barn, but pretty soon he reported that the handier deposits had petered out and thar wa'n't no use in scrapin' raound no more. I saw it was up to me to locate some other "pay dirt" sufficiently rich to justify further operations. In some places in the woods there were huge piles of sawdust, dark with age, left from long-ago lumbering. Surely that sawdust was living vegetation once. Although self-appointed experts told me it was worse than nothing, and I had a suspicion they might be right, I induced Samule, who by this time had borne about all he could, to dump some loads of this sawdust on the leaf mold and fork them together with lime and let it all lay a spell.

One of the old pastures, though now growing up to brush pretty fast, still had considerable sod ground. I had read that the secret of the fertility of Midwestern farms was the combination of alluvial soil and the sod, on which grass had grown extra tall and thick ages ago. We skimmed off and carted down loads of sod and dumped them on the other stores.

A user of humus becomes an addict and craves it more and more. So far I had been but a collector of it, now I was to take a further step. Since nature had been so stingy in depositing humus here in the past and was making it so slowly in the present, I set out to make it myself, and faster. I started compost piles, in convenient but hidden spots, on which all grass clippings and raked-up leaves and healthy weeds were to be dumped. At the edge of the woods nearest the kitchen Samule was influenced to dig a pit, the theory being that daily he should put into it layers of such garbage as his pigs wouldn't want, and coverings of earth. I tended those compost heaps, and I defended them from gradual abandonment by Samule or from sudden annihilation by order of Uncle John.

Compost, like wine, is bettered by a certain amount of aging. I had met a rich lady who had five bins of compost, each dated by the year in which it was "laid down," and I had noticed that Cambridge, Massachusetts, accumulates great vintage-dated heaps of compost down by the city dump, setting an example of thrift that other cities might well follow instead of burning their raked leaves and spending money for manufactured fertilizer. But I was neither a rich lady nor a city, and choice vintage composts were not for me.

At the end of two years I felt that the time had come to remake the lawn that had never yet been a lawn. I had need to draw upon the earlier layers of my accumulated stores. And behold, load after load of black crumbly humus was hauled out, in which all dissimilar elements had become similar, in which maple leaf was indistinguishable from chop bone and grass clipping from orange rind — in which all various forms were one in appearance and in virtue. This we mixed with the big piles of woods mold, sod, and sawdust and dumped the mixture around on the potential lawn.

"This stuff's a-spreadin' aout pretty thin, fer all the fuss we've been through," Samule observed.

There wasn't nearly enough, I could see that; and I knew that no amount of commercial fertilizer could supply what was wanting. Scientific fertilizer scientifically arrived at, I had once supposed, was of course superior to animal manure unscientifically arrived at, but now I knew better. Yet animal manure is seldom offered in the local market, and in the Damon barn only motorcars are kept. A car is superior to a horse for transportation, and to a cow for easy manipulation; a car can bring you the mail as well as a horse could, and—if it goes to the village—as many quarts of milk a day as a cow. But, nevertheless, while a car is standing in the barn there is one gift that it never, never gives. Of what use are exhaust fumes, I ask you?

The only thing was to grow

manure—to plant green crops on the spot and plow them under. An early summer crop of buckwheat was turned under, then cabbagy-looking Essex rape, then winter rye the next spring. That used up one year and nearly used up the Boss.

"If you're going to have any grass at all out there," he observed, "let's have it in our lifetime."

So the field was sowed for the final time with lawn grass. And the day came when those who had said there would never be any grass were saying there was too much. We had to buy a power mower; and if we didn't run it twice a week we had to do the Maud Muller act. But hadn't Voltaire said that he who makes two blades of grass grow in place of one renders a service to the state?

One who has used humus in horticulture falls into the way of thinking about other kinds of culture in terms of humus. Such education as he himself has—what is it but a compost of all the things he once learned and has in a way forgotten—a humus in which the original elements have lost their identity? Have not those green scraps of knowledge, mixed with tough experiences and ripened by time, turned into a kind of wisdom? He understands how it is that a word is said to have roots, and how its present meanings have grown up out of layers of old meanings. He sees a book as a small deposit of humus made from the writer's experiences and reflections, and a library as a great rich compost heap which has accumulated and preserved stored energy for future growth. Decayed literature, as Thoreau observed, makes the richest of all soils. He sees that certain periods of human history, such as the Periclean, the Renaissance, and the Elizabethan, are like certain geologic periods; they made better growth than others and laid down deeper layers.

A humusist comes to think the answer to many problems would seem to be more humus —more of that which was once vital itself and now has power to give vitality. For a soil, this might be a load of leaf mold or a green crop turned under; for a mind, it might be a page of history or an example left by a hero. To have a sense of humus is to have an appreciation of the past, to realize that to discard the achievements and virtues slowly built up through long periods of human society and to attempt to live solely in this present is like throwing away humus and trying to exist in more or less inorganic hardpan. A young human plant needs mellowed soil deep enough to encourage his roots to go down and rich enough in stored energy to give vigor.

One who works much with humus sees it to be a symbol of democracy, in which many work for the good of one, and one works for the good of many. He comes in time to honor the ideal of service for itself and not for individual recognition, of service great and unending in which small and brief services have been blended. He comes to hold the modest hope that his immortality may be in a diffused influence for good, the hope that among "those immortal dead who live again in minds made better by their presence" he may take his honorable but undistinguished part.

Samule unwittingly gave me one good lesson on this point —as on others. One day when on the porch were pretty ladies all in a row and in the garden I was struggling toward some ultimate improvement, I found the going pretty tough and began to indulge in compensatory thinking.

"Anyhow, I'm the one who is making the world a better place. I'm doing something permanent. What's that epitaph of Sir Christopher Wren, *'Si monumentum requiris, circumspice'*—or was it *momentum?* — something like that. Anyhow, my name will be remembered, just as I remember now——" and I looked about to discover some particular benefit from a predecessor over which I could be sentimental.

"Who planted that great mock-orange bush, Samule?"

"Oh, them? Them was planted—a good many years ago 'twas—them was planted by a woman we called Crazy Emmar."

"You called her Crazy Emma. Wasn't she really crazy then?"

Samule spat, psychiatrically.

"Wal, no, not really what yed'd rightly name crazy. She got the name of it fer havin' sech foolish notions as plantin' all sech stuff here at the edge of the woods. Thet's haow she got the name, fer plantin' like thet."

"It's a beautiful bush," I said. "And I never saw a larger one. About ten feet high, isn't it, Samule?"

"I guiss 'tis, 'baout thet—mebbe nine. Ef the truth's known, Mis' Damon, them bushes ain't really planted at thet. They're jest what Crazy Emmar called 'heeled in.' She wanted me ter do a lot of diggin' here, thar, and everywhar and set 'em aout, but of course I had other work ter do, but finally I did get raound ter jest

heelin' 'em in fer her, as she called it."

"How old now, would you say, Samule?"

"Oh, thet was 'baout thutty years ago, near's I kin make aout."

"Did Emma go crazy before you heeled them in, or after ——" I started to ask, but I didn't. I suspected it must have been while she was trying to get them heeled in. I kept on working away, and by and by I thought, " 'Crazy Emmar'—that's the way a good many reputations come down. Well, I don't mind; I've had the satisfaction of doing the work and of hoping some of it would last. I don't mind if some future owner does look around at my accomplishments and say, 'Poor old Bughouse Bertha.' "

"The Story of Sani-Soil"

ITS DISCOVERY AND APPLICATION

BY JOHN ALEXANDER

Vice-President and General Manager
Redwood Fibre Products Co., Inc.

LIKE so many other new developments, Sani-Soil is the result of an accidental discovery.

While producing a "Barkwool" insulation from shredded Redwood bark about 40 per cent of the product turned out to be a very fine and powdery material not suitable for insulation in construction work. It had to be separated in order to improve the quality of the regular "Barkwool" insulation. For several months it was dumped in the yards to be burned later. When it became necessary to dispose of it in order to make room for additional dumping space, we found that it was practically impossible to burn it, as this material would not support combustion. In order to get it out of the way we finally decided to spread it over several acres of land. This was done in May 1941.

In Santa Cruz, California, where the factory is located, during the period between May and December there is hardly any rain. In order to keep our flowers growing and our gardens green we have to water every day. Otherwise by late summer all vegetation is burned out and the ground is bare. To our surprise we found that the vegetation on the acreage covered by this fine powdery Redwood bark mulch showed the most luxurious growth. The plants attained an average height of three feet and better and the foliage had a deep dark green appearance. All seemed to be in perfect health. Just a few feet away the same vegetation on the same soil where this mulch was not applied had died out and the ground was bare of any plant life.

These startling results caused us to make further tests with this material and we induced Mr. Frank Reinelt of the Vetterlee and Reinelt Begonia Gardens of Capitola, California, to use it in his work with Primroses and Begonias. At first it was used in seed flats. The soil mixture consisted of one-third, by volume, of Redwood bark powder and two-thirds of leafmold with a light dusting of Sani-Soil over the surface of the seed flat. Quoting Mr. Reinelt's remarks on this experiment, "The method entirely eliminated the formation of any moss or algea. Germination was excellent. In fact, in this group we obtained the finest stand of Begonia seedlings we have ever had, with losses cut down to zero."

During fall of 1941 Mr. Reinelt planted a field of Primroses and topdressed the entire field with a 1½" layer of Sani-Soil. It eliminated 60 per cent of the usual watering, no weeding had to be done since the top mulch evidently smothered all weed seed germination, and all

plants grew to full maturity and remained in perfect health. Since then Mr. Reinelt has been using it consistently in all his plantings with excellent success.

On the strength of Mr. Reinelt's experiments numerous nurserymen throughout the United States have been using Sani-Soil and report similar results.

Tests were made by such outstanding horticulturists as Mr. E. O. Orpet of Santa Barbara, California, and Dr. V. T. Stoutemeyer of the U. S. Plant Introduction Gardens at Glenn Dale, Maryland. Reports from these sources were just as favorable.

Quoting Mr. Orpet from a letter written to the Editor of "The Florist Exchange and Horticultural Trade World" published in its issue of July 3, 1943, he had this to say:

"It is gratifying to learn that this product has now reached the East Coast so that growers there may benefit by the use of this product of the Redwood Tree. It has always been a problem to find use for this material. Those who have not seen these trees growing may not be aware that the bark is often more than 12 in. thick and must be taken off before sawing. Consequently there are at times, thousands of tons of this bark, which is difficult to burn and will not decay, so that it becomes a burden in all lumber camps.

I have long been familiar with shredded Redwood bark as a medium for placing bench grafts until callused, the material being used again and again until it reached the condition of leafmold, yet no trace of fungus was ever present after years of usage.

Concerning troubles with soils for pot plants, due to lack of aeration at the roots for which watering is often responsible, I have in mind Cyclamens which have fooled many, including the writer. But profiting by experience with this and other miffy plants that we are trying all the time, we tried as a matter of drainage and root aeration, the addition of a little Redwood fiber at the bottom of the pots. When the new roots found this, how they rambled, nice clean healthy roots that every plant man likes to see.

More recently we have tried the fiber, Sani-Soil, in place of the usual Osmunda material for orchids with amazing results as to root growth. In the first place it is impossible to overwater orchids growing in this material. Overwatering has caused the death of countless orchids growing in this material, but grown in the fiber it is not possible, as it does not hold surplus water at any time. Furthermore there is no decay and it remains a healthy rooting medium that will surprise anyone who tries it. It has been said by those who know that orchids will grow in anything, so long as it is free of humus which spells decay.

I am not in any way interested in the distribution of Sani-Soil, but after nearly seven decades of "trial and error", I am urged to tell others as I would like others to tell me, if they know of anything that unheralded, has proved to have so much value.

For packing delicate roots like Alstoemerias which are so liable to decay in transit if at all bruised when digging, it is ideal. A year ago we sent nearly 6000 of these roots East without a single loss and our clients have stipulated we use the same material again.

There are two grades, one a fine dusty material, the other with all the fibers fully separated. This latter is the grade used as a medium for orchid culture with surprising results."

In view of the fact that Mr. Orpet is one of the collaborators of L. H. Bailey's "Standard Cyclopedia of Horticulture", and the main author of the subject of "Orchids", and sole author of the subject of "Osmundie" it is a very gratifying tribute to Sani-Soil.

Since them thousands of users in every part of the country have tried Sani-Soil to good advantage on every type of shrub, flower, and vegetable.

Its slow rate of decomposition makes it an ideal conditioner for heavy type soils and fine soils that have a tendency to pack. Mixed into the top layer it will prevent packing, insure aeration of the root system, and increase the water holding capacity of the soil. One application will last for years and will keep the heaviest soils loose and friable.

To insure a uniform texture of Sani-Soil, special machinery was developed. Where before we had difficulty with Sani-Soil lumping when it was spread over the surface, this has been eliminated and it can be easily spread over a large area. This latter is of particular advantage where Sani-Soil is used to improve old lawns. Best results with old lawns were obtained when a top dressing of any regular organic fertilizer was applied and then Sani-Soil raked over this, after which a good watering about once a week was applied.

The lawns recovered rapidly and showed an extraordinary good growth and root development.

While a number of our agricultural experiment stations are working with Sani-Soil we feel that its value and application by the nurseryman is still a wide open field. So far we have only scratched the surface and the future no doubt will show some still greater values of Sani-Soil and its use in the horticultural field.

Second Debate in House of Lords

The Soil And Health

LORD TEVIOT had the following Notice on the Paper: To call attention to the Royal Commission which it has been decided to set up to investigate the birthrate and trends of population, and to ask whether the terms of reference cover the subject raised in the debate in this House on 26th October, 1943—namely, the Condition of the Soil in relation to the health of man, animal and plant—and to move for Papers.

THE EARL OF *PORTSMOUTH*: My Lords, I rise on behalf of my noble friend Lord Teviot to move the Motion standing in his name. This morning he telephoned that he was confined to bed with an acute attack of lumbago, and he asked me to present to your Lordships his apologies for not being able to move this Motion in person. I should also like, in moving the Motion, to absolve my noble friend from any responsibility for the manner in which I may do so. When the Royal Commission on population trends was announced on behalf of the Government by the noble Duke, the Duke of Devonshire, to me, at any rate, it seemed that it was a move which was, or could be, of more importance than anything else that has happened in the social life of our country in the last forty or fifty years. The way in which the noble Duke replied on behalf of the Government showed that, in his own mind, there was the same sense of this importance, and the feeling that the inquiry, if it is to be thorough, searching, and realistic, must go very deep, to the very basis of our civilization—that it cannot confine itself to one thing or another. It cannot deal merely with the shell or structure of our Social Services responsible for the vitality—for that is what it means—or lack of vitality. It must go far deeper than that. In that connexion I cannot help feeling that if the Royal Commission were to investigate this problem and not investigate the relation between the vitality of man and the vitality of the soil on which he feeds, it would be like producing *Hamlet* without the Prince of Denmark.

Those of us who are seriously interested in this aspect of soil nutrition and its bearing on the health of plants, and animals, and man, realize profoundly that this is only one aspect but it is, after all, the basis of a great deal of our lives. We can see outside, upon the London County Council buildings across the Thames, the sign, "Food is a munition of war—do not waste it." It is far more: it is a munition of life, and let us see that it is vital food. The difficulty in moving a Motion of this sort is not to find material for one's argument but to select material. It is difficult because there is such a wealth of it. I should like to-day to confine my arguments as far as possible to the findings of a group of people who are scientifically qualified in the highest degree and who have had a long experience of the matter we are discussing. I refer to the group known as the Peckham Pioneer Health Service. They are, as your Lordships are probably well aware, a group of doctors who have investigated over a period of years an urban cross-section of our population. They have confined themselves to no particular class. So that their experiment and their experience may be not made invalid by special arguments, their experiment has been confined neither to very poor income ratios nor to the very high income ratios, but covers a very wide cross-section of the population and a very wide cross-section of occupation as well. The point they were searching for was to produce health, to have research into health and its relationships.

They have begun with the family as a unit. Arising from their work with the family,

naturally the whole question of environment has come in and the most vital member of the family, the mother, has been the subject of their special attention. The noble Lord, Lord Woolton, the day before yesterday, made a most profound and interesting speech to a body called the Food Education Society and he expressed a wish in that speech that hospitals might become the centres of positive health. With all due deference I feel that the term "positive health" is there used in its wrong context, because positive health cannot begin with hospitals. Hospitals may be magnificent centres for rehabilitation, for teaching a better way of life to those who have been invalids, but they cannot be centres of positive health. Positive health, in my opinion and I believe in that of most of those who have thought deeply upon this question, must begin in the womb and indeed in the womb before conception starts, with the health and vitality of the mother. In that connexion the doctors working in the Peckham Health Centre discovered that feeding the families in the Centre with the ordinary so-called balanced food diet bought from a shop was not enough. The vitamins and so forth in the ordinary analysis of such vegetables as spinach and in such food as milk were not there; the vitality was not there; and they were forced to turn then to their own farm. They were forced to grow the food themselves, so as to get the beginnings of positive health in the unborn child, and the methods they were forced to use were the methods upon which Lord Teviot and others spoke in the debate on 26th October last. They were forced to use not new methods but the ancient method of returning waste to the soil and creating humus.

I think the importance of their work is to be found not only in the wide field covered but in the results of their original examinations. The number of individuals examined from these families ran into nearly four thousand. Of those a very large proportion had actual disease, but even more, the majority, were suffering from some disorder of which they were largely ignorant because it had not immediately affected them. As your Lordships know, it is quite possible to have cancer and to be ignorant of the fact. The majority of these people had some disorder which would affect them in later life but of which they were in ignorance because they had been able to compensate themselves in other ways. It was found that 10 per cent. had either disease or disorder. The most striking and I think the most sinister finding, however, was that among the nearly two thousand women examined only 4 per cent. were found to be without disorder. It seems that while many things may have contributed to this disastrous state in a comparatively well-off section of the population, even from their own findings the doctors were forced to get food which they thought would create the beginnings of positive health. There must be a very serious connexion between the food we eat and the health which it produces. It seems to me that we are too much concerned to-day to try to build the shell, the structure of the Social Services, too much concerned with pathological remedies and palliatives, and that we do not pay sufficient attention to the living organism which must grow within the shell, or in spite of it. I feel that we are confined far too much to-day in our farming and in our medical life within the scaffolding of pathology.

I should like at this point to draw a comparison. Before the war, for several years it was my privilege to be able to visit, sometimes once, sometimes twice each summer, two farms in Holland run by a most able and distinguished man, a man who was not only a great observer but one of the most practical men I ever met. Those farms were run on the line of creating humus from organic waste. They were market gardens as well. There you could see probably every disease that was usual—endemic or even epidemic—in the local countryside; red spider on the tomatoes and so forth; but in no case was the disease getting the upper hand. The animals had a bloom on them and a gentleness quite remarkable. They were being fed far more economically than most of us could manage to feed our animals if we were to obtain the same results. Their production was not higher than production on the neighbouring farms. There was disease, but health predominated, disease nowhere got the upper hand. When thunderstorms laid neighbouring crops flat the crops on these farms were standing up. That was one side. The other side was in the market. At that time when the world was being forced to restrict production because people were unable to consume, not because they did not want to consume, tens of thousands of lettuces were being dumped through the agency of the Dutch Government every day into the sea, and the same

thing was happening with other vegetables. But from these two farms, while all this destruction was going on, every vegetable which could be produced was being sold at from 15 to 20 per cent. above the ordinary market price. Families who were being supplied with food from those farms, as they had been supplied for years, said that they could manage on less of this food and they felt a great deal better. When they went for holidays they sometimes came back early because the children did not flourish in the same way as when they were at home. I am not saying that there is any great proof in that, but it was a very interesting picture which I was privileged to watch over a period of years.

Compare that with what you could have seen before the war on a visit to one of our research stations in England. There you could have gone into the laboratory and have had explained to you a new form of spray for poisoning aphides on apples. The history of the need for that new spray was that round about 1900, when apples were being sprayed with arsenic to keep them free from various attacks, several people died of arsenic poisoning through eating apples, so that a law was introduced prescribing the maximum amount of arsenic that could be sprayed on apples. But about 1935, 200 times the legal amount of arsenic was being sprayed on apples which had to be washed afterwards with some napthalene solution. The various parasites which the arsenic was supposed to kill had developed a resistance to arsenic, and although the strength was increased 200 times the parasites were still there. Therefore it became necessary to develop a new form of poison. But on those farms in Holland no sprays of any sort, apart from certain vegetable sprays, were ever used.

This same group of doctors has produced a report for the Association of Planning and Regional Construction. If I may I would like to make some short quotations. The Report says:

"Conditions necessary for the invalid are inimical to the continued validity of the valid. From this it follows that we cannot expect health from any policy — however efficient — which in effect is solely directed to the stamping out of sickness."

On the subject of hygiene, they say hygiene

"is now progressing away from pathology, *i.e.* away from direct methods of attack upon the parasite towards a self-sustaining balance in the living environment."

They say, speaking of the return of organic waste to the soil, that

"there is here evidence of a mutuality of function at work between soil, plant, insect, animal and man . . ."

And later on they say:

"We have, nevertheless, seen that the laws of pathology cut across the path of mutual synthesis. Their essence is separation from and reaction to (against) the environment. All disease and disorder are therefore inimical to health."

We live in our own islands in a world where at least lip service, accompanied at times with very deep conviction, is rendered to the fact that we have a religion which teaches love more than anything else; but however much we may feel that in our daily practice with each other we feel it infinitely more in our practice with the soil. We consider it far too often necessary to defeat nature. We talk of the struggle for existence and we forget that the earth could not carry on without all forms of life upon it, that we have a mutuality and synthesis working together. In all humility I submit that it is time that we very seriously considered whether we ought not now to investigate that mutuality and not every time the destruction of the parasite. I should like to quote a story of the family life of the dove. The dove sits for eighteen days. Male and female can both sit, and do sit. But four days before the young dove is due to be hatched both in male and female there is a secretion of saliva in the crop which enables the young chicks on being hatched to be fed with that pre-digested food from the crop. Without that saliva the young chicks could not be fed and could not live. If by any chance the eggs are addled and infertile the doves continue to sit but the crop saliva is not created. There must therefore be some relationship which we do not yet understand between the egg and the parents. Again, the male dove can be induced to sit without the female, but although the egg may be fertile he cannot produce the saliva of his own accord. He can, however, produce this secretion through the crop gland if injected with some of the saliva of the female. In other words there is a reason for billing and cooing.

I will not comment on the significance of this evidence in support of our deepest instinctive feelings for family life, but I should like to point out that it must have some parallel in terms of farming. As your

Lordships know, there is to-day a movement for the widespread and increased use of the artificial insemination of cattle. Is there, by reason of this particular parallel of the dove, anything which would give us cause to doubt. If so, we should make very careful investigations before we unreservedly adopt this new form of progress. We think in terms only of what is already ascertained, but in the relationship of the egg of the dove to the parents' crop there is evidence, I suggest, of influences which may vitally affect farming, in the relationship, for example, between plant and plant, in the action of humus and in the matter of the conservation of waste. I suggest that it gives us another parallel which should make us think. It is often said that the onus of proving the correctness of the doctrine of returning to natural farming should be upon the people who say that there is something in it. But it is not a new doctrine. It is as old as time. Surely the onus of proof should rest on the other side; that is, upon the people who have gone, without very deep consideration, into the newer forms of farming which tend to do away with the return of waste and to place reliance on the heavy use of artificial chemical manures, the pathological use of the poison spray and so forth. These things have been adopted as new inventions merely on face value. They may be very good. I am not denying that they may be right, but surely the onus of p r o v i n g their rightness should be on the school which professes to believe in them rather than on the school which holds by methods which have been tried for centuries and not found wanting.

We have done very quickly, in the name of progress, things which might concern human beings to the utmost. We have, for instance, accepted the necessity for compulsory vaccination—though it is no longer compulsory. We have jumped to conclusions about the pasteurization of milk, and many people to-day are ready to say that that should be compulsory. I shall not weary your Lordships by discussing these matters at length, but we all know that many doctors to-day are giving M. and B. 693, to their patients, less by reason of the nature of the disease than from the fact that patients like to think that they are getting up-to-date treatment and the latest benefits of science. We welcome the motor car as a great factor in human progress, and we do not object to it maiming or killing 250,000 people a year. If we are willing to take these things on their face value, is it too much to ask that this Royal Commission should undertake to consider whether there may not be something which is vital to life in the forms of agriculture which were debated on the 26th October? I do not believe it would be very expensive. It might take a long time but that would not matter. But we are in desperate danger now. If what we say is right, if there is anything in this theory, recovery will take a long time. Even if there is nothing in it we shall have gained knowledge, and still be able to go ahead with clear consciences. If there is something in it, the quicker a start is made, and the more thoroughly the investigation is carried out, the greater will be the benefit not only to this country but to the whole human race. And the cost of obtaining this knowledge would be just the merest fraction of the cost of obtaining another 100 miles an hour speed in the air.

One thing that we do know is that we have lost that full abundance of overflowing health which once we possessed. Picture the swallow curving in flight above the river in summer, or the teal dropping down at dusk. Consider the vigour and the beauty of their flight. Imagine a tigress with her cubs coming down in the evening to drink at a pool on the edge of a jungle; note the ripple of her sleek coat and the beauty of her colouring which, in its way, equals that of the wild peacock which she disturbs. And then think of the multitudes of human beings, 90 per cent. of them suffering from disorders, swaying wearily homewards in the Tube at night. In the rather self-conscious evening of our civilization cannot we use by every means in our power the knowledge which we have got in order to discover something which can give back to mankind the feeling of the morning of the world? My Lords, I beg to move.

LORD GLENTANAR: My Lords, I rise to support the Motion and the very able speech which has been made in moving it by the noble Earl, in the absence of Lord Teviot in whose name the Motion stands. As the noble Earl has said, those of us who support this Motion feel very strongly that an opportunity is given by the appointment of this Royal Commission to lose which would be a very great disaster. If we could be assured that one of the channels which would be explored by this Commission would be the close relationship

between the life of man, animal, plant and soil, we should feel that the Commission would be undertaking the task in its entirety and in a way in which no undertaking of its kind has ever been carried out before.

We are talking of life, and life on this planet, in relation to the great size of our planet, may be called a thin film upon its surface, a tenuous film which has been called the biosphere. It extends only a few inches into the surface of the ground and but a short way into the atmosphere and into the waters which cover the earth. It is easily and quickly destroyed; and so, if we look at it in this light, the existence of life on this planet may be a more precarious thing than we have hitherto imagined. Before the era of modern science, the close and complex interlocking of living things was clearly realized, for man's close contact with nature gave him an intuitive understanding of these things. To appreciate this we need read only such a work as *A Hundred Good Points of Good Husbandry,* by Thomas Tusser, written in the sixteenth century, and we shall realize that this went without question.

The study of matter, which developed so rapidly in the nineteenth century, from its very orientation, from its methods of analysis and searching always into smaller and smaller entities, became a method of disintegration from element to molecule, from molecule to atom, from atom to electron, from electron to quantum and so forth, and so the search continued always into smaller and smaller entities. The strides which science has made in these directions have been of the greatest possible importance, but until recently they have always been in one direction. A technique, a habit, a mentality has been acquired which has become almost universal. Aboard the good ship *Science,* the lookout post was for a time unmanned, because the ship's company were so busy peering at their charts and looking through their navigational instruments that they developed a short-sightedness which made them quite unsuited for going into the lookout and scanning the horizon.

This state of affairs was realized after a time by our deep thinkers, and especially in the world of biology, where the process of studying the small entities yielded unsatisfying results. But the biologists, with all possible respect to them, had in those days been trained in the school of nineteenth century science, and it was difficult for them to think of putting the ship's helm over and sailing in the opposite direction, the direction of synthesis and integration. Many of them, however, are now steering that course in different parts of the world, including this country, for biology has been emancipated and has received—I say it with all humility—a new inspiration. In supporting this Motion, I am one of those who do so because we feel that the opportunity is now open, with this Royal Commission, for the study of the whole and not of the part; and we feel that in this direction only are there reasonable chances for the re-establishment and maintenance of health.

I plead with His Majesty's Government to support a long-term, wide-range research into the whole organism comprising man, animal, plant and soil. I ask your Lordships' indulgence so that I may quote from a most important work by Field-Marshal Smuts, which he wrote in 1926, called *Holism and Evolution,* which had a most profound effect on the contemporary thought of the time. In that book he said:

"Both matter and life consist, in the atom and the cell, of unit structures whose ordered grouping produces the natural whole which we call bodies or organisms. This character or feature of wholeness which we find in the case of matter and life has a far more general application, and points to something fundamental in the universe, fundamental in the sense that it is practically universal and that it is a general operative factor, and that this shaping influence is felt ever more deeply and widely in the advance of evolution."

Again, he says:

"The whole as a real character is writ large on the face of nature. It is dominant in biology; it is everywhere noticeable in the higher mental and spiritual developments, and science, if it had not been so largely analytic and mechanical, would long ago have seen and read it in inorganic nature also."

These are very i m p o r t a n t words, and I think we can take them well to heart to-day.

As the noble Earl who has just spoken has said, research into the nature of the whole may be often a much more expensive, difficult and slow process than research into the nature of the fragment; but in the matter with which we are concerned to-day no difficulties are too great and no perseverance too exhausting if we can make progress in this extraordinarily important and fundamental matter. I suppose that nothing in the nature of research exact-

ly of this order has ever been attempted before. That it will be undertaken either in this or in some other country before long is, I think, certain, because the writing is clear upon the wall. In the continents where man's lack of wisdom has caused less obvious havoc than it has here, the writing can be more clearly seen. The recent United Nations Conference on Food and Agriculture at Hot Springs has recommended that a permanent body should be established to deal with the varied problems of food and agriculture, not in isolation but together, and in its unanimous findings it has emphasized the relation between the quality of food and the productivity of the soil. We ask that that be extended one step further to include the realm of human nature. International collaboration in this field would, of course, be of the greatest possible value, and after the war there is no reason why experimentation of this kind in different countries could not and should not be linked closely together.

We have got a wonderful opportunity in these islands. We are most singularly suited to carry out research of this nature, because we can find soils between full fertility and barren want, where experimental work, already carried out, can be observed and larger and more carefully co-ordinated experiments instituted. This will need the whole-hearted cooperation of scientists in every field, but the experiments, I am convinced, should be carried out under the direction of impartial and independent bodies. It may well be that these researches would show us not only the way to better health and a stronger and more abundant population, but may also show us fundamental faults in our sociology and our economics, and they may indicate certain remedies. We may find out, as some of us suspect, that in a country of whose population only so small a proportion is engaged in agriculture compared with other industries, we shall need to take steps to alter this proportion.

The latest figures I have been able to find are in the 1931 census, from which I see that in England, Scotland and Wales together the proportion of men and women over fourteen years of age occupied in agriculture, compared to the total number in all industries, is a figure of only about six and a half per cent. The proportion may have altered during the war, but I doubt very much if it has increased materially, because, although we have so much larger an acreage under cultivation, still the amount of mechanical apparatus which we are using must greatly counterbalance the increase in agricultural employment, and at the same time the number of women employed in other industries has been so very greatly increased. That, to me, is a very disquieting figure. I wonder whether it is possible for a population to be healthy if only about six and a half per cent. of it is engaged in the natural pursuit of tilling the soil. In the study of the problems of population most disquieting statistics, I believe, exist as to the low fertility of urban families entirely composed of town-bred people for more than two generations, and it will be surprising if, in the researches to be undertaken into questions of population, more disquieting facts still are not revealed. In the study of the whole we may find that the well-being of man is the paramount consideration and that his place in the whole organism, his life and function in relation to other forms of life, should be the controlling factor. In recent times the demands of economics have to a great extent usurped this central position in the system, and if we find through our researches that nature insists in the long run in preserving in full measure the well-being of living things, we shall know better how to go forward.

LORD HANKEY: My Lords, I should like to apologize to my noble friend Lord Portsmouth that through an official engagement I could not be here in time to hear his speech. I agree very much with what the last speaker has said about the great importance of research, and research not by one but by a number of Government Departments. In any such research the Agricultural Research Council would necessarily play a very leading part, and I do not want to advance one step without saying how regrettable it is that at this moment we should have lost the services of Dr. Topley, the late secretary of the Agricultural Research Council. It seems only a short time since he was the secretary of the Scientific Advisory Council and I was the Chairman, and we delivered ourselves of an immense Report. I was working very closely with him, and among the subjects of the Report, as I duly reported to your Lordships at the time, was some reorganization of the Agricultural Research Council, and Dr. Topley, because of the work he had done on that, was appointed as secretary of the

Agricultural Research Council, in which office he was doing the most splendid work, literally up to the moment of his death.

In rising to speak on a question like this, I do not pretend to speak as an expert. I have no broad acres; but in my own tiny patch of England it does happen that I have tried out for about seven years the methods of organic manures, and especially composts, which lie behind this Motion, and I have tried them out with very great success. But one swallow does not make a summer, and I am not attaching any importance whatsoever to that in what I have to say. I am rather one who is very much impressed, and rather disturbed, not only by the speeches made by Lord Teviot and others on October 26 last, but also by a great number of books and pamphlets and speeches which I have read, including one by my noble friend who introduced the Motion, which seems to necessitate inquiry. The point I wish to make is that the only demand here to-day, as I understand it, is for inquiry, which was supported in the last debate by a demand for experiment and research, even if it involved some years. On that question of years, when it is remembered that the researches of Hopkins and the Mellanbys and a great number of others which led to the discoveries of nutrition, took thirty years, we ought not to be dismayed if these researches should take, maybe, ten years. The noble Earl, Lord Portsmouth, in the last debate said possibly twenty years. Until some of these experiments have been made, judgment can be suspended.

What I am going to appeal for to-day is that the two parties should get together as to the experiments which would certainly be required for the Royal Commission. If the parties could get together they would not have any difficulty in agreeing on the range of experiments. There is much more common ground to begin with in this matter than is generally realized. As I understand the case of Lord Teviot and his friends, at the bottom of it is the dependence of health on an adequate and well-balanced diet, including the necessary protective foodstuffs required for health. That is the accepted teaching of agricultural scientists and nutritional scientists. There is agreement there. Secondly, it was quite clear from what my noble friend the Duke of Devonshire said in the last debate that there is common ground as to the great importance of humus in the soil. There is common ground also that, whether you have artificials or not, you must have an adequate supply of organic fertilizers. Again, compost is admitted by the supporters of the chemicals to be a very valuable form of organic fertilizer. The composters place it much higher, but nobody denies that it is a valuable form of organic fertilizer. The composters quite agree that other forms of organic manures are of great value, such as farm manure, muck, sheep-folding, and so on. Some people think they did not, but in fact, unless I am greatly mistaken, in the Haughley experiments mentioned in Lady Eve Balfour's book they did use not only compost, but a great deal of these other organic manures.

Then there will be general agreement on the danger of erosion of the soil. Nobody could possibly doubt the danger if they did what I did. I went to Australia to see my father's sheep-run, which he had left somewhere in the 1870's, and it had simply gone—gone to the desert and to rabbits—erosion. There will be general agreement also that the worst offenders are those who, farming in neglect of scientific principles, destroy the fertility of the soil and rendering it liable to erosion. Then it would be agreed, though I am not quite so sure about this as about the other points, that municipal wastes for the purpose of manufacturing compost and manuring the land should be encouraged as much as possible. Even in that agreed range there is room for a lot of action to be initiated by a Royal Commission or an inquiry.

May I now come to the main items of disagreement? The first, and far the most important, is the use of some inorganic fertilizers, particularly sulphate of ammonia, which are anathema to the compost school. Running with that, some people have very strong suspicions of the mechanical tractors which they think crush the earth worms which aerate the soil. The second doubt is as to whether, in fact, compost does give the additional resistance to disease in plants which is claimed. That is very much doubted by some people. The third point of difference—and this is a very important one—is with regard to the claims of the composters as to the additional value of food grown on compost and organic fertilizers as compared with the artificials. These, I believe, are the three great points of difference. Even on the most controversial question of all—the question of artificials—there are two points on which, I believe, there must be

agreement. One is that artificials have, in fact, produced remarkable results in boosting food production in the present war and in the last war all over the world. The composters say the price paid is too high. Perhaps these artificials have been used in too great quantities, and have injured the soil, but they have, in the emergency, produced the goods. The second point is the vital importance of maintaining the chemical industry in the interests of Imperial defence and, some would say, in the interests of having the means of boosting the soil if another emergency should occur.

These are some points where there is probably agreement. I submit that when you think of the advantages an inquiry on the agreed points, and of the immense desirability of testing out the very strong *prima facie* case made, there ought to be an inquiry and there ought also to be experiments. I am quite convinced, from personal investigation, that some of the experiments have already been initiated not as part of this theory, but as part of the general work of the Agricultural Research Council. I say so because I made some search in the White Paper on Agricultural Research in Great Britain (Cmd. 6421 of 1943). Scattered through that Paper there were many subjects, I noticed, which are mentioned in all the books on this matter. They would have to be, so to speak, put under one head, co-ordinated, brought together, to be of value, but a great deal of research has been made and is being made. My suggestion, whether the Motion is agreed to or not, is that as soon as possible after the return from his travels of the noble Earl, Lord De La Warr, who is Chairman of the Agricultural Research Council, the parties should be got together, Lord Teviot and his friends should meet the representatives of the Agricultural Research Council and the Medical Research Council (and I hope some Minister would take a hand), and they should agree at any rate upon the first stage in the researches and the arrangements on which the last speaker laid considerable stress.

LORD GEDDES: My Lords, I rise to support the demand put forward by Lord Teviot that, if possible, there should be associated with the work of the Royal Commission research into what is really the subject of the vitality and reproductive capacity of the men and women of the country in so far as that relates to food. The speech we have just heard from Lord Hankey covers a good deal of the ground on which I had intended to address your Lordships. There is no doubt whatever that you can produce from the fields a great quantity of food by the use of chemical fertilizers. That is undoubted. You can boost production, and that is what I think has blinded a great many people to the real problem. The food that we eat and the foodstuffs which we absorb into our body fluids, and through them into our tissues, are divided sharply into two parts, possibly more but certainly sharply into two parts—the part which is required as a fuel to provide the energy for movement, for all those activities in which we as men and women can indulge, and the part which is required to repair and replace and recreate our actual bodies themselves. Now it seems pretty clear that so far as the fuels are concerned they are not necessarily of such fine and precise composition in order to be useful to us as are those portions of our food which go to the building or rebuilding of our own bodies and tissues.

There is a very long history behind this controversy. It goes back for nearly a century and it has been made a very difficult controversy to follow by the dominance for so many years of the German school in connexion with biology. The German school — Virchow, Schwann, Liebig—laid the emphasis upon the cell out of which in their millions our bodies are created and they regarded food for the cell as all that was required. Apart from that, and really obliterated and eclipsed by the German school, very likely as a result of the Franco-Prussian War and the prestige the Germans got through that war there was a French school of which Professor Béchamp was the leader working at Montpellier in the fifties of last century. This school had a quite different idea about the structure of the body and the vitality and vigour of the body, and I think it was a great pity that as a result of the Franco-Prussian War and various things that followed it in the 'seventies a great deal of the work of Professor Béchamp was entirely ignored and overlooked.

One of the great contributions he made, a contribution with which I have been familiar now for over thirty years, to the whole idea of life, was that the cell was not the unit of life, but that there was a much smaller, more minute unit of life which he called in his later reports to the Academy of

Science the microzymases but which in his earlier reports he had always referred to as the "little bodies." They really are composed of little living bodies. No one knows very much about them although any competent microscopist is thoroughly familiar with them in the practical field of the microscope. These little living bodies, which exist in organic matter even long after it had been dead as an organism, have the power quite definitely (there is nothing mystical about them) of organizing life, because they are themselves alive. The only proof I can give you that they are alive is that you can kill them, and I do not think you could kill a thing that was not alive. These little living bodies are not present in the artificial chemical manures, and it may be that the German school, which we have in this country very largely followed in biology for many years, overlooked something of great importance, and it may be that it is necessary for our human bodies, if they are to maintain their full vitality, to be receiving in their food a continuous supply of these little living bodies.

We all get a certain number of them every day, but it may well be—and this is the point that is really at issue between the schools of thought—that because those little living bodies are not present in sufficient quantities in a man's or woman's food he or she begins to lose the physical capacity for vitality. And that is the point at issue. It is not really a matter of theory or mysticism at all. There is a real divergence of opinion between two schools which have existed for a long time, one of which has become dominant and out of whose practice and beliefs the whole of the chemical fertilizer industry has arisen and has been able to show results of the most remarkable kind in boosting production in the plant's growth and those portions of the food which are required as fuels. It may well be that the compostors have got hold—perhaps without knowing it—of the real source of vitality. They are the most extraordinary things, these little bodies. I do not know how many of your Lordships are accustomed to handle a microscope, but if you are and you can get in a dark field of illumination a drop of your own blood you can see them. They shine like stars. In the course of this week I have seen a great many drops of blood under the microscope and the difference between people fed in different ways and in different states of health is quite extraordinary. That is where this controversy really leads. It does not lead to differences on this point or that point or the other point in agriculture. It leads straight to one point, and one point only: Is the supply of these little living bodies in the food essential to the continued vitality of human beings or is it not? That is the research that is wanted and I cannot imagine that anybody dealing with the question of reproduction—it is a question of vitality—is going to overlook the fact that there is that great outstanding question in the pathological field.

A great many things have happened recently to shake the predominance of the German school. It no longer carries the full conviction which it did when I was a student forty-five years ago. Once again there is no proof at all, and I trust that nothing I have said will be taken as meaning that this thing is true; but there is undoubtedly the possibility, many think the extreme probability, that the presence of these little living bodies—microzymases, as Professor Béchamp called them—in the food is essential to vitality in health. They cannot come into the food grown on the fields unless there are a great many little living bodies of that sort in the soil, because they come from the soil. They cannot apparently get into the soil unless they come from living matter before. Whether they are things that can multiply I have not the slightest knowledge. You find them in the most antique remnants of life. You actually can find them still existing in the chalk which has been formed as a rock for millions of years. I do not know whether they are the original living bodies that were there when the marine animals were there or not, but it has been proved that we can actually use these little living bodies out of the chalk in a pure sugar solution, with every antiseptic precaution taken to prevent any inflow of other germs from outside to start organization in a sugar solution which is sterile and dead. That, as I see it, is the problem. It is a purely scientific problem that is presented to us, and it is one which I believe can be answered with a combination of research by the Medical Research Council, the Agricultural Research Council and of observation carefully conducted and carefully checked on the people of the country fed on different foods. Right at the back of all this controversy that goes on there is this Franco-German evidence. If we can get that settled we shall know where we are.

VISCOUNT BLEDISLOE: My Lords, I hardly like to be silent on such a subject as that which has been raised by the noble Earl. I think the impression that all your Lordships must have derived from the very illuminating speeches to which we have listened is that there is a great mass of most important scientific research which ought to be carried out at the earliest possible moment in the best interests of human health. Whether this particular consideration—namely the relation between what I prefer to call the morbid condition of soil, plant, animal and man—comes within the terms of reference, or can be brought within the terms of reference of the Royal Commission over which I am glad to know the noble and learned Viscount who sits on the Woolsack is going to preside is, I think, matter of considerable doubt. Whether the terms of reference can be amplified, as I for one should like, in order to introduce this particular aspect of scientific inquiry which may or may not bear on the reduction of the birth-rate, is a question which the noble and learned Viscount is better qualified to answer than I am. But even if this particular inquiry cannot come properly within the terms of reference of the Royal Commission, I think—here I follow in the trend of thought of the last two speakers—there ought to be an inquiry, which by the way can be rapidly pursued and the results of which might bear very considerably upon the important question with which the Royal Commission will be asked to deal.

After all, it was only just over one hundred years ago that our first agricultural research station, Rothamsted, was established in this country, largely if not entirely owing to the enterprise and vision of Sir John Bennett Lawes and his able colleague, Professor Joseph Henry Gilbert. At that time it was assumed that the only science which bore materially upon the nutrition of plants was chemistry. Since that date, and particularly during the last thirty years, we have realized more and more the mistake that was then made, and physics, bacteriology and micro-biology are known to have as much to do with the growth of plants, including, of course, food plants, as the science of chemistry. Therefore we ought to keep an open mind and be prepared if and when this further inquiry takes place to accept the theory that there is some inter-relation between soil, plant, animal and man which very materially affects the health of the last-named.

Reference has been made to the passing away of Dr. Topley. We must all seriously regret that. It is very remarkable that the number of scientific agriculturists or agricultural scientists who have during the past few years passed to their rest is so large. There is one name which has not been mentioned, and that is Sir John Farmer. He was a great biologist and did perhaps more than any man in recent years to draw attention to the enormous importance that the science of biology enjoys or should enjoy in relation to the nutrition of plant and animals if not of man.

I spent five years in a remarkably fertile country, the Dominion of New Zealand. In that country there are more serious soil and water deficiencies, so far as we know, than have been found in any other country in the world. Now there is no doubt whatever that, in that country, a certain number of ailments are deemed to be traceable to soil or water deficiencies, deficiencies, that is, in something essential to human health. But, so far as I know, with but a single exception, there are no instances in which it has been definitely and conclusively proved that such is the case, that cause and effect are at work in such matters. The one exception relates to the prevalence of goitre, which is traceable to lack of iodine. I suppose that in few countries in the world is there more goitre to be found than in a certain area in the north of the South Island of New Zealand, and there the artificial addition of iodine to table salt, and to water has proved an absolutely certain preventive of the disease. If that is the case in regard to goitre, surely it is more than likely that something of the same kind applies to other soil deficiencies as producing a condition of human morbidity.

All I wish, really, to emphasize, in view of our having had two important debates in this House on the subject, and of the serious view which so many of our own experts here take in this matter, is that without delay there should be instituted some definite scientific inquiry into this question of the interrelation of morbid conditions between the soil, plant, animal and man. I feel, for my own part, as the late very learned Sir Daniel Hall felt, that the case is not proven, and until the case is proven I cannot think that we are justified in asking the Royal Commission to pursue this particular line of inquiry unless and until their

terms of reference are amplified so as to embrace it.

I must apologise to the noble Earl, Lord Portsmouth, for not being in my place when he opened this debate, because we always listen to him with very great interest. I may say that the agricultural community feels very greatly indebted to him in that he, among the younger practical agriculturists of this country, is taking such a very prominent interest in the welfare of agriculture, and in the relation of science to its well-being and progressive development. I venture to hope that this debate will not pass unnoticed, that the value of the arguments which have been put forward in the course of it will not be unrecognized by the noble Viscount who will preside—as we all feel assured—with great ability over this Royal Commission, and that, in one way or another, the considerations which have been raised will be taken into account.

LORD SNELL: My Lords, your Lordships will sympathize with the noble Lord, Lord Teviot, in the indisposition which has kept him away from your Lordships' House to-day. He would, I am sure, have returned with renewed enthusiasm to the subject which he raised on the 26th October last. But in the noble Earl, Lord Portsmouth, Lord Teviot found a worthy substitute, and the noble Earl and others who have spoken to-day have restated and extended the considerations which were advanced during the last debate in your Lordships' House. The contention was, and is, that the use of artificial fertilizers instead of natural humus is the cause of much of the prevalent disease in man, in animal and in plant. My noble friend, Lord Geddes, on the last occasion, related faulty nutrition, through the poverty of the soil, to the loss of fertility in man and to the fall in the birth-rate. Well, that is a most important subject, and it requires close and, perhaps, prolonged study before a definite decision can be made upon it. But it is all to the good that groups of students should be examining this matter and that it should be considered by Parliament and other bodies.

Your Lordships will notice that, in the debate which has taken place to-day, there has been singularly little argument devoted to the contention that the problem should be referred to the Royal Commission. We have had a good deal of philosophy, medical and otherwise, but very little has been said in relation to that specific point which is the reason for the Motion being put upon the Order Paper. The noble Earl, Lord Portsmouth, said that there was something faulty in our nutrition. Well, he is not the only person who, during the last four or five years, has said that with a certain amount of feeling. But, when the attempt is to relate malnutrition to lack of human fertility, I have in my mind the fact—at least I think it is the fact—that the largest families were always to be found in the poorer section of the community, that is in the section where malnutrition was greatest, and that in proportion as the standard of nutrition rose you got a reduction in the size of families. My noble Friend Lord Geddes quite properly said that, in his judgment, this was a purely scientific problem, and the question that arises is whether a purely scientific problem can be dealt with by the Royal Commission which has been proposed.

The response of the Government to the arguments adduced on the last occasion was given by my noble friend the Duke of Norfolk, and I have nothing to add, really, to the statement which he then made. The Government reply, as stated by the noble Duke, was that the Minister of Health at that time had no evidence of ill-health in the community due to the use of artificial fertilizers in food production, and also that the scientific evidence available pointed to no antagonism in agriculture between artificial fertilizers and natural humus, but to the beneficial results of both in their proper place, at their proper time and in the right proportions. He added that the points raised in the debate would be brought to the notice of the Ministries concerned—the Ministries of Agriculture, of Health and of Food. That view of the Government still stands. I can repeat what the noble Duke said on the last occasion, and say that the arguments advanced today will be noted by the Departments concerned.

If I may be permitted to make a personal observation, it is this. The fall in the birth-rate may be due to many causes, of which that raised by the noble Earl to-day may well be one; but I suggest that it is unscientific, and perhaps unsafe, to attribute that fall in the birth-rate to one cause alone. There may be, as I have said, many causes, and among them we may be sure that social considerations and reactions will count for a very great deal. For good or for ill—I am not here to say which—it is

probable that the day of large families is over, at least for our time. Children may be and are a source of great joy, and of great consolation in old age, but the people of our time no longer believe with the Psalmist that that man is happy who has his quiver full of them. They have other views, right or wrong. Those factors have a great deal to do with fertility, and therefore it is probably unscientific, as I say, to associate the problem with one factor alone.

With regard to the Royal Commission, in drawing up the terms of reference, the Government were careful to make them so comprehensive as to exclude nothing which might have a bearing on the present trends of population. Perhaps your Lordships will permit me to remind you of those terms of reference:

"To examine the facts relating to the present population trends in Great Britain; to investigate the causes of those trends and to consider their probable consequence; to consider what measure, if any, should be taken in the national interest to influence the future trends of population; and to make recommendations."

Your Lordships will note that the Commission is asked to investigate the causes of the present trends of population, and it may be that certain methods of soil cultivation are amongst those causes. If the Royal Commission so decides, it can under its terms of reference examine that question; but the Commission must be absolutely free to decide upon the scope of its inquiries, and it must itself determine the evidence which it shall receive.

It has been admitted over and over again in the debate to-day that the subject is complicated, and that it raises very obscure and remote questions. If the Report of the Royal Commission is to wait until there has been a thorough-going examination of all the problems concerned, we may have to wait a very considerable time for it. I think that the noble Earl, Lord Portsmouth, suggested that twenty years might be a reasonable time, and Lord Geddes suggested ten years. If my noble and learned friend the Lord Chancellor feels equal to sitting in the chair of the Royal Commission for the next twenty years, well and good; but the noble and learned Viscount has had the advantage of hearing what your Lordships have had to say, and he will have noted the various suggestions which have been made. The field of inquiry is a very large one, and, while excluding nothing that it would be helpful to examine, at the same time the Commission will have to see to it, as my noble friend Lord Addison said on the last occasion, that its inquiries are kept within the scope necessary to enable it to get on with its work with due rapidity.

LORD HANKEY: My Lords, with your permission I should like to ask whether the noble Lord can add a word in reply to my appeal that he should get together those who have raised this question with the Government Departments and in particular the research departments concerned, with a view of starting the experiments and the tests.

LORD SNELL: My Lords, with the permission of the House I would recall to my noble friend Lord Hankey that I said that the suggestions which have been made will be put before the Departments concerned and duly considered. I cannot, of course, answer his question.

THE EARL OF PORTSMOUTH: My Lords, the noble Lord, Lord Snell, who has just replied for the Government, has not ruled out the possibility of research, but on the side suggested by my noble friends Lord Hankey and Lord Bledisloe he has not given us much encouragement. I have forgotten which Governmental phrase it is—whether "active consideration" or "urgent consideration"—which means that something may happen, but I do hope that consideration of the priority kind will be given to this matter by the Departments concerned. If I may be allowed to correct one or two misapprehensions on the part of the noble Lord who has just replied, I do not think that any of my noble friends who have spoken on this Motion said that the use of artificial manures is the cause; we said that it may be the cause, and we want it investigated. Secondly, I should like to correct what seems to me a misinterpretation of the term "malnutrition." We realize that not only is there under-nutrition but there is also faulty nutrition or malnutrition. Under-nutrition is quite different from malnutrition. I do hope that this consideration will be active, not only from the noble and learned Viscount's point of view as Chairman of the Royal Commission, but from that of the scientific and research departments of the Government itself. I beg leave to withdraw.

Motion for Papers, by leave, withdrawn.

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ORGANIC GARDENING,
Emmaus, Pa.

Reader's Correspondence

Dear Mr. Rodale:

Since subscribing to your invaluable magazine a year ago, we have been trying to put some of your good advice into practice. We have about an acre of clay with very thin gravelly topsoil made acid by fifteen large white oaks. It is hard to grow good lawn on this soil and we hope to improve it gradually by composting. What and when is the best method of applying compost to a lawn?

Last summer we made two heaps by layering grass clippings, garden refuse, wood ashes, garbage, topsoil, oak leaves and manure, gradually, as they were available, as we did not have sufficient material at one time. We did not turn the heaps as they were not finished until late Fall. Then, on the advice of the Ohio Earthworm Farms, we p l a n t e d worms in the center of each heap, covering each with a thick layer of manure, topsoil, leaves and boards. What is your criticism of this method? Our only difficulty was attracting rats—can you suggest how we might avoid this next year?

Our vegetable garden was planted on a section of our land which was a barnyard 25 years ago. We had surprisingly good results for amateurs but we want to deepen the topsoil and get better root crops. In order to make the best use of our limited supply of compost we are thinking of trenching it for each row instead of broadcasting it. Would you advise this? If so, how deep and wide should the trenches be?

Organic Gardening is a fascinating subject and has given us new hope in improving what we thought was impossible soil. Any specific advice you can give us will be deeply appreciated. Every copy of your magazine is eagerly read and filed for reference.

Elizabeth B. Apsey,
Towson, Maryland.

Answer

Dear Mrs. Apsey:

The best time to apply compost on a lawn would be in the Fall. For such a purpose your compost would have to be screened and only the finer part of it used. It is a different matter when you plow under compost for use with a vegetable garden or a farm. Please remember also that you can use purchased peat humus for lawns.

We would rather breed earth-

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worms separately, than planting them in the compost heap. By breeding them in boxes or pits you will have them under your control and can then use them wherever they are needed most. Perhaps rats will be attracted more, where there is an unusual amount of earthworms in the compost heap. We have no trouble with rats in our ordinary compost heaps.

We would approach the subject of trenching cautiously. We did a great deal of it last year, but feel that it should be used only with certain crops like carrots, that require a soft bed for the carrot to form in. The roots of vegetables spread out so wide that it does not do any harm to broadcast the compost over the entire surface. I believe it is a mistaken idea to concentrate c o m p o s t only where the seeds are sown, thinking that the plant only feeds at that point.

Organic Gardening:

I would be interested in a further discussion of the ideas expressed in "Milk—and Manure Top Dressing" which recently appeared in Organic Gardening with particular reference to the mechanics of getting the liquid manure onto the land without an expensive outlay or substantial human effort almost weekly. As I see the results are highly desirable and will eventually be obtained by all well-run farms. What I don't see is the most economical way of setting up the procedure. The minimum equipment for a barn built on low land would seem to be an excavated cesspool or tank, a pump and large hose, a tank mounted on a truck and a spreader. Any ideas would be appreciated.

S. Bradford,
Hamilton, Mass.

Answer

Dear Mr. Bradford:

There is very little additional than can be given besides what was in the original article. This provided for a 3,000 gallon concrete cistern and 400 gallon tank on the truck, connected with the trough pierced with holes and attached to the back of the truck. The tap of the tank is simply turned on and the truck driven rapidly over the fields. A blacksmith would understand this and be able to make one of these if the material is available.

This method, of course, would not be practical unless you had surpluses of milk to dispose of. Otherwise, it would be much too expensive.

To my way of thinking, a better method would be to apply the skim-milk in the compost heaps when they are made. In the ideal case of making these heaps, as each layer of green matter is placed, water is usually applied. Instead of water you might apply skim-milk.

The reason this m e t h o d would be better is that the milk would ferment and decay in the heap more readily and quicker than on the land. Should a sudden big rain come up after this material is applied to the land, a great part of it would be washed off; whereas if it was contained in compost applied to the land and plowed or disced in quickly, this would not happen.

Question:

I have read in an advertisement of a chemical activator to speed the process in the compost heap, that lime should never be put next to manure as it will release the nitrogen of the latter. Yet, according to Sir Albert Howard's instructions, lime *does* come in contact with the manure?

Answer

This is an old belief which is fallacious. The New Jersey Agricultural Experiment Station recently made experiments with poultry manure which showed that hydrated lime actually aided in the retention of nitrogen rather than in dissipating it.

Dear Mr. Rodale:

After reading the sample copy of Organic Gardening you recently sent to me I have decided to subscribe and also to order a copy of Sir Albert Howard's book An Agricultural Testament.

I have been experimenting in making a compost heap using leaves with some waste from fruit and vegetables and adding Adco to *help* bring about decomposition quicker.

I wrote the Agr. Exp. Sta. at Rutgers Univ., N. J. asking

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ORGANIC GARDENING
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about Adco. In reply they sent me a circular of how to prepare artificial manure. I have enclosed a copy. On page five a formula is given to help decomposition. I would like to know whether preparing artificial manure using chemicals would be detrimental to the ground?

I intend to start in the spring to experiment with earthworms as an aid to soil fertilization.

Allan J. Field,
Cliffside Park, N. J.

Answer

Dear Mr. Field:

We note that you are making compost heaps using leaves and the chemical known as Adco. Chemical activators are usually recommended where there is a scarcity of animal manure. Rather than use such chemicals, we would rather purchase such things as bone meal or dried blood and use them in place of manure. Usually where chemical activators are employed, the finished compost has a sour odor, which is not found where a compost heap is one hundred per cent organic.

We received the booklet, which is circular No. 470, entitled "Synthetic Manure" issued by the Agricultural Experiment Station, New Brunswick, N. J. In this booklet pictures are shown of corn and other plants grown in pots. In the pot where the chemical has been added to the compost, the corn towers much higher than that where no chemicals were used. The experiment station did not make any test to determine the nourishing qualities of the corn. Mere size of a plant is no indication of its value as food. Food, blown up in such a manner, is a waste of time of the human digestive system.

Another drawback in these agricultural station experiments is that they are done in pots and not under regular farming conditions. For example, in the case of the corn shown, the plant has not grown to maturity but is only a few weeks old. The pots are very shallow. It would be interesting to see what would happen when both of these stalks are in the final stages with the corn cob formed. It might show very little difference in the size of the corn cob but a great deal of difference in its nourishing qualities. This experiment does not take into consideration the effect on the soil of the continued year to year use of such chemical and what it would do to it after say five or six years of such abuse. Take the case of my own farm. We grew about eight acres of wonderful quality corn last summer with the exclusive use of compost, produced without chemical activators, perhaps about 7 to 10 tons per acre. The corn we harvested was far superior to that raised by neighboring farmers. That is the kind of experiment to make and not in flower pots.

We then fed this corn to our steers and the results were truly remarkable. A local butcher, who bought one of them stated that it was the finest meat he had ever seen in his entire career as a butcher.

Gentlemen:

I ordered Hydrated Lime, when it came it was "marble dust". Can I use that in composting?

Mrs. M. K. Gordon,
Knoxville, Tennessee.

Answer

Dear Mrs. Gordon:

Marble dust could not be used exactly in place of lime as it would be extremely slow in acting. Hydrated Lime

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Thos. J. Barrett,
Earthmaster Farms, Box C-10,
Roscoe, Calif.

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A phamphlet of 64 pages answering many questions about the best way to make compost. This book consists of material that has appeared in Organic Gardening from time to time.

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Organic Gardening
Emmaus, Pa.

should be used, but it is an excellent thing for the soil although its action is very slow. There is a certain school of thought which practises what is known as "clean culture". They make compost heaps of plant material only, and are against the use of animal manures. In addition they use lime and stone dusts which consists of stones ground up as fine as a powder.

I hear a great deal about plowing under green manure crops. Is this practical for the small vegetable garden?

Answer

It would be practical as far as growing the crop is concerned but under average conditions I wouldn't plow it under. Rather than leave your garden bare over the winter it is an excellent idea to sow ryegrass. In the spring, before your planting operations begin, it would be best, to cut off the ryegrass and compost it. The exception would be in a case where you have been applying compost for five years or more and your soil is very rich organically. Its power of digestion of green matter becomes very high and in such case perhaps it might be plowed under. If it was my own, however. I believe I would rather compost it, regardless of how rich the soil was.

Experiments have shown that plowing under green matter gives rise to great increases in bacteria who proceed to break it down. The trouble is, however, that they consume much food from the soil to furnish energy and thus interfere with the next crop. In the year following, though, the effect of this broken down green matter acts favorably.

Dear Mr. Rodale:

On Dec. 25th, Christmas day, we tried to burn some Sage Grass, and the fire got away from us and killed about 12 of our 5 year old fruit trees. We have never tried to plow this grass under, as the land is quite steep, however we are going to try to plow it under this spring, if possible.

Ross W. Barcus,
Rush Run, Ohio.

Answer

Dear Mr. Barcus:

Regarding the sage grass which has quite a heavy stem, what you might have done would have been to have gone over this grass in the fall with a heavy roller so that it lay on the ground. The action of the snows, covering it completely during the winter and also in the spring, would prepare it and reduce it so that the plowing under would be much easier.

I have noticed this condition with regard to field corn. Many farmers, after husking the corn, leave the denuded corn stalks standing up rigidly all winter. On Rodale Farms we go over the corn fields with our roller in the late fall and see to it that it all lays down flat. Right at the moment, it is completely covered with a fine layer of thick snow.

Hoping you will have better luck with your sage grass next year.

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NAME .....
.....
ADDRESS .....
.....

Dear Sir:

I have finished reading An Agricultural Testament by Sir A. Howard. When I returned the book to its owner I enclosed the following note:

"This book is worth while and several copies should be in all public libraries. Also it should be compulsory reading in the High schools, both urban and rural."

Sir A. Howard deserves our thanks for his missionary work in bringing the value of Humus so forcibly to the attention of people who while they may not work on the land yet have a vital interest in the produce from the farm, meaning of course their food.

To us who were raised and trained in horticulture in Europe making a Humus pile is an old story. My first recollection along those lines was way back in the Gay Nineties. My granddad who died when I was nine years old owned a small place of about 4 acres. He kept a pony to help him out in his work and I used to watch with interest the way he mixed all leaves and garden trash; in fact everything that would decay with his stable manure. He went to some trouble to explain to my juvenile mind the value of this mixed compost.

As I took up Horticulture for a living almost without exception the Humus pile was a feature and I today give credit to the way of economical handling of all garden waste for that proud record that Britain has attained for high class Horticulture.

In 1910 I came to the States and in 1912 my employer who owned an estate in New Jersey called me in and said, "I have just bought 1000 cu. yds. of topsoil. Can you handle it and how"? Now our land was very sandy and lacking in humus. As this soil he bought was definitely on the heavy side I explained to him that I intended to drop it on a piece of land of about 2 acres which would raise nothing but purslane. When levelled down the coverage was about 6 inches deep. We always saved all garden trash, leaves, cabbage stalks, corn stalks and what-not. The heap attained quite a volume by Fall. The last job my summer help did before being laid off at Thanksgiving was to turn over this heap, it was left till spring and was then finely pulverised. Now previously this land was so poor that my employer had warned me not to attempt to grow potatoes or any crop that cost money as he was tired of planting 3 barrels of potatoes and gathering a crop of at the most 5 barrels. I felt that after adding the topsoil and giving a heavy dressing of this humus it would be safe to take a chance with the potatoes again. There was no manure added, no fertilizer. I planted one barrel of Beauty of Hebron potatoes, an early variety. Those potatoes were sprayed twice with Arsenic of Lead. The Colorado potato beetle was a pest then. The potatoes were cultivated every week until the tops fell and I gathered 24 barrels of firsts and one barrel of seconds from that one barrel of seed potatoes. No manure, no fertilizer, no Bluestone coverage but I did spray for the Potato bug twice and I give the credit to the Humus. Of course the heavy soil of a six inch depth helped.

Since then I have had many similar experiences of using decayed humus and producing first rate crops especially as to quality. There was a time when I used to grow exhibition Dahlias. After planning the stakes in position I would open up a hole of say 4 spadesful put in a bushel of this Humus and then dig deeply and thoroughly mix making the worked hole say 3 ft. in diameter. From that treatment I grew some of the largest, best blooms in the New Jersey area. I should say it was my practice to add a handful of Bone Meal to the Humus as most organic manures are short of phosphate. Enough of this for the time being but keep up the good work. I feel as a farmer did who wrote some 40 years ago. The farmer who uses Lime and artificial fertilizers to excess may make money for a while but he will leave a poor heritage to his children—viz a run down farm.

Tom Hambleton,
Butler, Pa.

Dear Mr. Rodale:

Do you believe in inoculating leguminous seeds?

Allen Zurcher,
Apple Creek, Ohio.

Answer

Dear Sir:

Inoculation of seeds no doubt produces results in soil which has been farmed for years with chemical fertilizers. In such soils bacterial life is definitely at a low ebb. My hunch is that after a soil is put in good organic heart which might take five or six years, it then would be unnecessary to do any inoculating because the soil would be so rich in bacteria that it would be like bringing "coals to New Castle". Not enough experimental work has been done on this point.

AN AGRICULTURAL TESTAMENT

By Sir Albert Howard, C. I. E., M. A.

Formerly Director Institute of Plant Industry Indore, and Agricultural Adviser to Central India and Rajputana.

Sir Albert Howard C. I. E., M. A.

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This is the recognized standard text book for gardeners and farmers who wish to change from the use of ordinary chemical fertilizers to home-made organic fertilizers. Sir Albert Howard has forty years of active experience in the field of organic fertilizers and is the accepted leading authority on the subject.

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